The BLUE JAY

A JOURNAL OF NATURAL HISTORY AND CONSERVATION
FOR SASKATCHEWAN AND ADJACENT REGIONS

Vol. XXVIII, No. 1 Regina, Saskatchewan March, 1970

Adult Giant Water Bug (see page 47)

Photo by Whiteshell Nuclear Research Establishment

Published quarterly by the
SASKATCHEWAN NATURAL HISTORY SOCIETY
Regina, Saskatchewan

Individual Responsibility

All through the sixties naturalists have been voicing alarm because certain wildlife species are obviously in trouble. Gradually we have come to realize that it is the health of the whole environment that is in danger. Certain lakes and rivers are virtually dead, our air and our soil are becoming increasingly contaminated, and if pollution continues to accumulate there is real likelihood that the ecosystem will collapse causing an unprecedented die off on this earth. Some experts think that man will be able to avert the disaster, will be able to recognize the problems and make corrections in each specific case before it is too late (as he did, for example, in his efforts to save the Whooping Crane from extinction). Others believe that each correction will add new problems which will interfere with the complex balance between living things and thereby hasten the collapse of the natural world.

In the midst of such a complicated situation natural history laymen may be tempted to feel that, as individuals, they can do little to prevent disaster. But there are projects in which these people can play an active role. I am thinking particularly of support for the preservation of natural areas. Two articles in this issue, one on "*The Red Tide in Regina*" (p. 50) and the other on "*Wildlife-pesticide research*" (p. 2), indicate the difficulty involved in the whole matter of attempted preservation of nature. Certainly, much research will have to be done and it may even be that we are already too late to reverse the detrimental trends which are taking place. A negative attitude, however, will accomplish nothing. We must try to decide what the fundamental problems are and then attack these problems with vigor. We are all in a position to make our voices heard by writing letters and contributing money.

For what *specific* purpose, you well may ask.

Each natural history society can acquire some natural habitats. True, these will be subject to various pollutants carried everywhere by air and water; this fact is inescapable. But it is possible to preserve at least some fairly natural habitats. The Regina Natural History Society, for instance, has a half section along the Qu'Appelle valley which is still fairly natural but which is threatened more and more seriously each year as people look for places to dump their garbage, ride their snowmobiles and develop ski and other recreation areas. We must take definite action to meet these threats. The Saskatchewan Natural History Society has two areas under lease for protection of certain plants and animals but these areas can be protected and extended only if they are actually owned by the society. At the moment, some individual landowners are privately preserving small natural areas but since one's life span is limited and unpredictable, such individuals should clearly spell out their intentions in their wills. Possibly some group like a natural history society could agree to accept the responsibility of seeing that their wishes are implemented and their favorite areas preservd in perpetuity.

Recently the Nature Conservancy of Canada has expressed interest in helping to buy natural areas in Saskatchewan. We should, of course, buy and preserve these areas ourselves, but if Nature Conservancy will help with some of the initial cash, we can proceed to collect money to repay them, thereby enabling them to buy other areas. A national agency which is interested in saving unique and representative samples of our environment all across Canada is an organization with a positive approach. Let us support it wholeheartedly. If we cannot (for the time being) do anything else in the present pollution crisis, we can at least give what money we can spare to the sanctuary fund of the Saskatchewan Natural History Society or to Nature Conservancy for the purchase of natural areas in Saskatchewan or in any part of Canada which we care to specify.

THE BLUE JAY

Published quarterly by the Saskatchewan Natural History Society
Founded in 1942 by Isabel M. Priestly

Second class mail registration number 1046

Vol. XXVIII, No. 1 MARCH, 1970 Pages 1 - 60

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THE NEED FOR WILDLIFE - PESTICIDE RESEARCH IN SASKATCHEWAN*

by **Donald A. Blood,** 311 - 21 Street East, Saskatoon

Do Pesticides Harm Wildlife?

Earlier research into the effects of pesticides on wildlife attempted to document direct mortality in the area of application, at the time of application. Often such mortality could not be demonstrated (e.g. Folker, 1960). Gradually, much evidence has been accumulated to show that low residue levels of the persistent organochlorine insecticides are concentrated by relatively resistant organisms, and are magnified at each step (trophic level) of various food chains in various habitats (Rudd, 1964). Carnivorous and piscivorous species at the top of complex food chains thus accumulate very high residue levels, even in a relatively uncontaminated environment.

Still more recently it has been shown that these insidious, sub-lethal side-effects can have far-reaching consequences for wild populations. In fact, recent discoveries in this area rank among the most profound and startling ever made in environmental biology. In both Great Britain (Ratcliffe, 1963; 1965) and North America (Hickey, 1968) it was the decline of the Peregrine Falcon which initiated concern about the extent of harmful effects of environmental contamination. The population changes are **without parallel in the recent history of bird populations** (Hickey *op. cit.*). They include the pending extirpation of the Peregrine in northwestern Europe, the complete extirpation of the nesting population of this species in the eastern half of the United States, and simultaneous declines among other bird-and-fish-eating raptors, on both sides of the Atlantic. More recently it has been shown that, on both continents, the Peregrine populations which showed declines were characterized by egg-eating and by the production of eggs which showed reduced shell weight and thickness (Hickey and Anderson, 1968; Ratcliffe, 1967). A similar reduction in shell thickness has been shown in eggs of Herring Gulls (Hickey and Anderson, *op. cit.*), White Pelicans and Double-crested Cormorants (Anderson *et al*, 1969), and Prairie Falcons (Fyfe *et al*, 1969). Similar phenomena have been produced experimentally using Japanese quail (Bitman *et al*, 1969) and Mallards (Heath *et al*, 1969). Experimental studies have very recently elucidated the mechanism whereby organochlorine compounds interfere with reproduction. A wide variety of those insecticides or their metabolites, including DDE, will induce increased production of hepatic microsomal enzymes in both mammals and birds. These enzymes in turn break down (by hydroxilation) the steroid hormones which play a major role in regulating calcium metabolism and eggshell thickness during egg production (Peakall, 1967; Risebrough *et al*, 1968).

Effects on mammals have been less thoroughly studied, although similar food chain relationships have been found. Sherburne and Dimond (1969) found levels of DDT and its metabolites to be from 10 to 90 times as high in mink (up to 12 ppm) as in hares collected in the same habitat in Maine. Gilbert (1969) fed wild-caught fish containing low levels of DDT metabolites to ranch mink and found significantly decreased blood counts and increased embryonic loss. These studies suggest that **present environmental organochlorine levels have a potential for initiating population losses in carnivorous mammals.**

The recent research results which conclusively show that spectacular and widespread avian population declines are a direct result of impaired reproduction induced by organochlorine pesticide residues do not appear

*Opinions expressed in this article are those of the author and not necessarily those of the Saskatchewan Department of Natural Resources.

to have been forcefully brought to the attention of those people manufacturing, distributing and using persistent biocides. Professional entomologists are still stating that they "are unconvinced that DDT has any widespread harmful effects." Such ignorance of ecological fact must be corrected. Likewise, it does not appear to be appreciated that most of the insidious reproductive effects are not due to DDT itself, but to its metabolite, DDE, a compound of demonstrably lower acute toxicity than its parent. However, 80 to 90 per cent of the residues normally found in biological material are DDE, and it is now clear that **DDE itself is a thoroughly capable steroid degrader.**

Is There a Potential Problem in Saskatchewan?

It has been stated by many people, including scientists and laymen, that pesticides are little used in Saskatchewan relative to many other areas in North America, and therefore it is inferred that research into wildlife-pesticide relationships is not an urgent matter here. Indeed, extensive pesticide spraying such as that employed in the orchards of southern Ontario, spruce forests of New Brunswick, and vegetable farms in California has not been used here and is not presently being carried out. As a result, organochlorine pesticide residues in Saskatchewan soils are apparently low compared with a few other Canadian localities where analyses have been conducted.

Saha *et al* (1968) found all dieldrin levels in 20 soil samples from the northeastern agricultural area of Saskatchewan to be below 0.30 p.p.m. (85% had 0.10 p.p.m. or less), and found *no* evidence of DDT. In contrast, Duffy and Wong (1967) found dieldrin levels of 0.75 to 4.0 p.p.m. in soil from the Maritime Provinces, and 45% of their samples contained residues of DDT and its metabolites between 1 and 9 p.p.m. In 31 soil samples from southern Ontario, Harris *et al* (1966) found DDT and its metabolites in excess of 0.1 p.p.m. in 24 samples, and an average of 61.8 p.p.m. in orchard soils. They found dieldrin and/or aldrin in excess of 0.1 p.p.m. in 16 of the 31 samples. Thus it appears that average residue levels in **some** Saskatchewan soils are relatively insignificant as a source of wildlife contamination.

However, it would be unwise to be complacent about possible harmful contamination of Saskatchewan wildlife for several reasons:

1. There is now world-wide contamination by organochlorine and other pesticides, particularly DDT and its breakdown products. During application, in particular by aerial means, much of the spray never reaches the ground, but goes into the global air circulation and falls as rain or snow (Risebrough *et al*, 1968a, 1968b). This explains DDT in Antarctic penquins and Arctic polar bears in more than trace amounts. Virtually all living organisms, including Saskatchewan's wildlife, contain residues.

2. Even in areas of low environmental residue levels, *certain* species, i.e., those at the top of food chains, may suffer due to trophic level magnification of residues. The bird-eating and fish-eating birds are particularly vulnerable. Saskatchewan has several good examples of such contamination, documented by Fyfe *et al* (1969), Vermeer (1969) and Anderson *et al* (1969).

Fyfe *et al* (*op. cit.*) have found a 34% decline in breeding populations of Prairie Falcons in six study localities in southern Alberta and Saskatchewan during the past 10 years. The decline has been concentrated in four of the six areas, and characterized by high organochlorine levels (1-22 p.p.m. in eggs), thin eggshells, and poor nestling production. In the two Saskatchewan areas studied, The Big Muddy and South Saskatchewan River valleys, the former has maintained its falcon population levels while the latter has suffered an almost complete decline. Regional differences appear to be related to food habits, those individual Falcons that feed mainly on birds (e.g., Horned Larks) being more heavily contamin-

ated than those primarily eating ground squirrels (R. Fyfe, personal comm.). Vermeer *(op. cit.)* collected eggs of 21 species of aquatic birds, including gulls, terns, cormorants, pelicans, herons, grebes, avocet, coot, Canada goose, and ducks from 22 localities in western Canada, including 10 in Saskatchewan. Analysis for organochlorine residues showed that the eggs of gulls (except Franklin's), and of fish-eating birds such as cormorants, pelicans, herons and grebes, contained highest residues (up to 26 p.p.m.), while those of ducks and geese were much lower (up to 1 p.p.m.). Anderson *et al* (*op. cit.*) reported on organochlorine levels in pelican and cormorant eggs in Minnesota, North Dakota, Manitoba and Saskatchewan (Suggi Lake). While they found no levels above 0.1 p.p.m. in fish eaten by those birds, they found egg residues as high as 45 p.p.m. DDE and 28 p.p.m. PCB's (polychlorinated biphenyls) in cormorants, and 4.8 p.p.m. DDE and 1.2 p.p.m. PCB's in pelican eggs. This indicates a magnification of 50 to 500 times in one trophic level.

3. Migratory species may pick up residues in southern wintering areas, then return to nest in Saskatchewan. Since these are part of our breeding bird fauna we should be concerned if they are contaminated, regardless of the source. In addition, contaminated migratory songbirds contribute to food chain contamination as described above. Peregrine Falcons have been found to be highly contaminated in such remote areas as interior Alaska (Cade *et al*, 1968) and the Northwest Territories (Enderson *et al*, 1968) from feeding on migratory insectivorous birds which winter in southern agricultural areas but nest in the boreal forest.

4. There may be, and probably are, local areas in the Province where high levels of pesticides enter the environment. This may be a result of local treatments for grasshoppers or wireworms, or from pesticide abuses such as dumping of excess treated seed grain, or drainage of unusued gallonage from sprayer tanks. Abuses resulting in severe contamination of livestock or poultry frequently come to the attention of veterinarians; thus there is no reason to expect that wild species are not similarly affected on occasion. Very strong concentrations of aldrin, heptachlor and lindane are still used to dress seed grain for wireworm control. Wireworm outbreaks are most serious in the western two-thirds of the province and Burrage (1963) states that " . . . in spite of the widespread use of chemical seed treatments, the potential wireworm hazard has not diminished." Extensive collections of upland birds in Alberta for mercury analysis have revealed several "hot spots" where it was later determined that abuses had occurred. Although mercury levels in Saskatchewan upland birds are quite low, it is apparent that a few birds acquire higher than background levels, probably from seed grain. The origin of such contamination needs to be traced to its source.

Whose Responsibility is Wildlife-pesticide Research in Saskatchewan?

Pesticides pose a threat in two general areas—wildlife conservation and public health. The threat to human health through ingestion of residue-laden wildlife is essentially a Public Health problem, yet public health agencies have been little concerned with it. The Federal Food and Drug Act makes provision for residue testing in food products sold commercially, but this does not include wildlife products. Both Federal and Provincial Departments of Agriculture test for residues in forages and feeds, and in agricultural products such as milk and meat. **There is no similar program to protect the consumer of the wildlife resource.**

It might be argued that since Wildlife agencies get revenue from the game consumer in the form of license fees, and since they actively promote their product and are essentially marketing it, that they are responsible for some degree of quality control. Acceptance of such a premise would put additional onus on wildlife agencies for residue monitoring. Be that

as it may, the responsibility of wildlife agencies for **conservation** of species under the respective jurisdictions cannot be disputed.

The Canadian Wildlife Service has taken an active stand on pesticide-wildlife research in Canada, and its responsibility in the area of migratory birds—including fish-eating species such as pelicans, herons, and cormorants—is well founded. They are also heavily involved with certain species of raptors (which come under provincial jurisdiction) particularly Prairie and Peregrine falcons, because of the world-wide plight of those species. The Federal Government should be encouraged to continue these studies and to initiate new ones. However, at present, the C.W.S. Pesticides Section is only equipped to conduct fairly broad studies, and it is obvious that because of manpower and financial limitations, the Provincial wildlife agencies will have to be responsible for local and short-term studies, particularly where detailed ancillary information on local pesticides use is required.

What are our Immediate and Long-term Research Needs?

1. Immediate

a). A review of past and present use of organochlorine pesticides in Saskatchewan including types of chemicals, distribution of use, amounts used (per year and since use began), and reason for use. A map could then be compiled showing the degree of exposure of various parts of the Province to chemicals applied within the Province. This would greatly help in the interpretation of residue level results in wildlife.

b). A comparative survey of pesticide levels in the eggs of raptorial birds. Eggs are relatively easy to collect and form an excellent standard of comparison. In addition, there is good evidence that residues in eggs provide a reliable index to fat-stored contamination in the female, especially in birds with small clutches (Stickel, 1968). A small number of nestlings and/or adults of the more abundant species could also be collected for analysis. This would provide needed information on: 1) comparative levels in species of varying food habits, 2) relationship of levels in eggs, nestlings and adults, and 3) regional variations in contamination of resident species.

c). A survey of organochlorine and mercury levels in tissues of game birds. Specimens could readily be collected by various field staff already in the Province. Very detailed data concerning locality (down to quarter section) and pesticide use in the area must be collected with each specimen. These data are needed 1) to assess any possible public health hazard, and 2) to try to pinpoint "hot spots" of pesticide abuses.

2. Long-term

2). Studies of trophic level pesticide relationships on study areas in Prairie, Parkland and Forest ecosystems. Residue levels in soils and vegetation would have to be determined as well as in avian and mammalian herbivores, carnivores and insectivores. Detailed knowledge of food habits would also have to be obtained. Such studies would provide a valuable insight into ecological magnification of pesticides in various food chains in three habitat types, under **Saskatchewan** conditions. Active participation of the universities, as well as government agencies, would be prerequisite for such studies.

b). Experimental studies to determine residue levels which will induce eggshell thinning and reproductive failure in Saskatchewan's native raptorial birds. Such studies would again have to be conducted largely under the auspices of the Universities. This would involve captive rearing of certain species such as Short-eared Owls and Marsh Hawks.

c). Studies of variations in carcass deposition of pesticides in game birds eaten by man. The relative amounts of residue deposited in pectoral muscle, viscera and visceral fat should be determined, and the effect of fat mobilization and seasonal changes in physical condition on pesticide levels and their intra-carcass distribution.

d). Additional data are needed on

home range and migratory movements of all species likely to carry significant residue loads. These data are required to relate residue levels in wildlife to those in the environment.

Who Should Finance Pesticide-Wildlife Research

An expanded program of research into biocide side-effects is obviously necessary in Saskatchewan, as well as elsewhere, and will require considerable money. In addition, the virtually complete contamination of even remote areas now dictates that assays for DDE be made before the results of many other studies, particularly of reproductive success and behaviour, are taken seriously. This adds an additional financial burden to many studies.

Since it is primarily studies of wildlife-pesticide relationships, conducted by wildlife ecologists, which have pointed out possible horrendous implications for mankind, there would appear to be an obligation on behalf of the general public to support such research. It is unrealistic to expect the existing budgets of Provincial Wildlife agencies to accommodate such research. Increased funding should come from the following sources:

1. Increased allotments of Provincial Government funds to the Wildlife Branch for staff and equipment for pesticides research.
2. Federal government cost-sharing of such research.
3. The large corporations which produce pesticides should feel an obligation, if for no other reason than public relations, to support directly such research, and should be approached for funds.
4. The sportsmen and naturalists of the province should also contribute directly, since they stand to gain (or lose) more than other segments of the public.

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WILL C. COLT'S 1893 MIGRATION RECORDS FROM OSLER, SASKATCHEWAN

by **C. Stuart Houston,** 863 University Drive, Saskatoon

A recent trip to Washington, D.C. and a side trip to the nearby Patuxent Research Refuge allowed me to solve a small mystery of long standing. Years ago I obtained a set of the mimeographed Bird Migration Memoranda of the U.S. Biological Survey, 1936-1941. The second published an honour roll of bird migration observers with the longest periods of service, and on this list was Will C. Colt of Gilroy, California. He had sent in migration records for 48 years from South Dakota, Saskatchewan, Washington and California, but no Saskatchewan date or locality was given. I had also noted in Bent's *Life Histories of North American Birds*, numerous 1893 migration dates from Osler, Saskatchewan, without any clue as to the observer involved. Both omissions were explained when, through the kindness of Chandler S. Robbins, I was able to see the original submission from Osler, Saskatchewan, N.W.T. by Colt in 1893.

These records were submitted to Professor Wells W. Cooke as chairman of the bird migration committee of the American Ornithologists' Union and became the property of the U.S. Biological Survey in 1901 when they appointed Cooke to their staff to continue and extend this work. Colt had already submitted migration data from Harrison in southern South Dakota in 1889, 1890 and 1891. Thus he was an experienced observer and his records appear more reliable than those of many others of his day, before the time of good field guides and binoculars. His excellent list of 110 species is the only record we have from within the area of the forthcoming *Birds of the Saskatoon District* and is a valuable addition to our knowledge of bird distribution and abundance in the days of early settlement.

Following the columns of the official forms supplied, Colt listed for every species the date first seen with the numbers of each seen that day. No further numbers were requested (one regrets that there was not a column for maximum number seen in one day) but one can obtain some additional indirect evidence from the two days next seen (if abundant, they would be recorded for each of the next two days) and by his statement of either "Common" or "Rare", two terms he used without modifying adjectives. A final "last seen" date is supplied for migratory species that went on further north. Also of value are nesting dates for 27 species.

The names used were those of Elliott Coues' standard text of that time: such as Yellow-rumped and Summer in place of Myrtle and Yellow Warblers, Brown Thrush for Brown Thrasher, Silver-tongued Song Sparrow to differentiate from the Swamp Song Sparrow, Buzzard for Vulture. I would assess his sight identifications as exceptionally accurate for his time, although at least some of his flock of 10,000 McCown's Longspurs must have been immature and female Laplands and his Herring Gull may have been a California or Ring-billed. His identification of two species of scaup, and of the Black Duck, may have been inaccurate; his nesting Winter Wren was certainly in error, and his Prairie Falcons might have been Peregrines. His April record of a shrike was correctly given as Northern, but the June nest must have been that of a Loggerhead.

Some of the larger birds, such as Turkey Vulture, Whooping Crane, Upland Plover and Long-billed Curlew, were commoner then than now. He had one record of the Whip-poor-will (there are also a number of records from the earliest settlers in the Yorkton area at about the same time). Our three commonest species of gulls can now be seen daily throughout the summer but were either rare or absent in 1893 before cultivated fields were common — one

presumes that these species have since increased with the advent of agriculture. No doubt Colt failed to notice some of the smaller sparrows and flycatchers through lack of familiarity with their songs, but of greatest interest are the other species he failed to record. The Eskimo Curlew and Passenger Pigeon were no longer present and the Mourning Dove had not yet become common. Mountain Bluebirds then were largely confined to the southwestern corner of the province and the Black-billed Magpie was not yet ubiquitous. Due to the ravages of wide-sweeping prairie fires, heavy bush was scarce or absent except in the coulees along the river bank and the Ferruginous and Red-tailed Hawks were not recorded. The Blue Jay, Baltimore Oriole and American Goldfinch likely became common later when poplar bluffs grew up, and the Bohemian Waxwing likely increased in winter numbers after domestic fruit trees were planted.

Colt lived on the banks of the South Saskatchewan River (12-39-4 W3) just downstream from Clark's Crossing, and about 18 miles from the village of Saskatoon which then had a population of less than 100. Colt probably arrived in Saskatchewan in the fall of 1892. He lists the "N. Partridge" (Ruffed Grouse), Sharp-tailed Grouse and Great Horned Owl as winter residents, with an entry for 100 Snow Buntings seen on January 1, 1893. His last record was for June 30 and his submission was dated July 14; so it is likely that he left that summer. He did not file for a homestead. One suspects from his extensive observations that he spent more time birdwatching than farming, if indeed that is what he was supposed to be doing. In this regard, a check of an 1893 calendar failed to show any "clumping" of observations on Sunday, as might be expected with a working man.

Perusal of *The North Battleford Herald* confirms that the spring was very late in 1893. Colt saw his first gopher on April 6, though the ground was still covered with snow on April 10. On April 14 he saw the first water on the river ice. Monday, May 1 was a beautiful warm day with the still-present snow melting very fast and that day and the next came a remarkable migration of large numbers of many species all at once; the river ice went out on May 4.

We do not know Colt's whereabouts for the next five years, but 1899-1902 found him sending records from Badger, Holt County, Nebraska. In 1904 he moved to Washington, first at Mission, then Argyle, then Cashmere in 1905. In 1907 he moved to Modesto, California, and then settled finally in Gilroy in the Santa Clara valley of California. There in 1915 he did a summer bird census for Wells W. Cooke and reported 36 pairs of 10 species nesting on a 60-acre tract of wooded hillside. He submitted migration dates continuously until 1941.

I wish to thank Chandler S. Robbins, Chief of Migratory Non-Game Bird Studies, U.S. Fish and Wildlife Service, for allowing my sons and me to copy these records; thanks also to D. H. Bocking for providing information from the Saskatchewan Archives.

Birds observed at Osler, Saskatchewan by Will C. Colt, 1893

Species	Date first seen (number); next two dates; last date	Occurrence; Breeding?
Common Loon	May 16 (10); May 19	Rare; No
Horned Grebe	May 16 (2); May 24, 28	Common; Yes—May 30
White Pelican	May 1 (10); May 2,5; May 18	Rare; No
Great Blue Heron	May 10 (1); May 14	Rare; No
American Bittern	June 10 (1); June 12, 19	Rare; —
Whistling Swan	May 1 (15); May 2,4; May 20	Common; No
Canada Goose	April 1 (1); April 16, 26	Common; Yes—June 20

Species	Date first seen (number); next two dates; last date	Occurrence; Breeding?
White-fronted Goose	May 1 (12); May 2,8; May 21	Rare; No
Snow Goose	May 1 (20); May 2,4; May 22	Rare; No
Mallard	May 2 (1000); May 3, 4	Common; Yes—May 30
Black Duck	May 2 (6); May 4, 7	Very rare; —
American Widgeon	May 2 (12); May 6, 8	Rare; —
Pintail	May 2 (300); May 4, 6	Common; Yes
Shoveler	May 2 (500); May 4, 7	Common; Yes—June 21
Green-winged Teal	May 2 (50); May 3, 4	Rare; Yes
Blue-winged Teal	May 2 (50); May 3, 4	Common; Yes
Redhead	May 2 (10); May 4, 7	Rare; Yes—June 21
Ring-necked Duck	May 2 (10); May 6, 7	Rare; —
Canvasback	May 2 (10); May 4, 6	Rare; —
Greater Scaup	May 2 (75); May 6, 8	Common; —
Lesser Scaup	May 2 (15); May 6, 7	Common; Yes—June 20
Common Goldeneye	May 2 (50); May 4,6; May 18	Common; No
Bufflehead	May 2 (25); May 4,6; May 10	Rare; No
Ruddy Duck	May 7 (2); May 9	Rare; Yes
Turkey Vulture	May 1 (10); May 2, 8	Common; —
Broad-winged Hawk	Apr. 22 (2); Apr. 25, May 3	Rare; No
Swainson's Hawk	Apr. 29 (2); Apr. 20, May 4	Common; Yes—May 29
Marsh Hawk	Apr. 14 (1); Apr. 17, 19	Common; Yes—June 10
Bald Eagle	May 2 (1); May 5	Rare; No
Prairie Falcon	Apr. 11 (3); April 14, 23	Common; —
Pigeon Hawk	May 8 (2); May 9, 13	Common; Yes—May 16
Sparrow Hawk	Apr. 22 (2); Apr. 24, May 5	Rare; Yes—May 21
Ruffed Grouse	Present in winter	Rare; Yes
Sharp-tailed Grouse	Present in winter	Common; Yes
Whooping Crane	May 1 (3); May 2, 5; May 25	Common; No
Sandhill Crane	May 1 (12); May 2, 5	Common; Yes
Sora	June 10 (1); June 14, 17	Common; Yes—June 13
American Coot	May 1 (50); May 2, 10	Common; Yes
Killdeer	May 1 (25); May 2, 3	Common; Yes—May 12
Golden Plover	My 8 (150); My 9, 10; My 27	Rare; No
Upland Plover	May 14 (10); May 17, 18	Common; Yes—May 27
Common Snipe	May 8 (6); May 9,13; May 25	Rare; No
Long-billed Curlew	May 7 (25); May 8, 9	Common; Yes
Willet	May 10 (2); May 12, 15	Common; Yes—June 1
Lesser Yellowlegs	June 20 (25); June 23, 27	Common; —
Solitary Sandpiper	My 19 (20); My 20, 30; Jn 10	Common; No
Least Sandpiper	My 19 (70), My 20, 30; Jn 19	Common; No
Dowitcher sp.	June 20 (50); June 13, 30	Common; —
Marbled Godwit	May 10 (2); May 12, 17	Common; Yes
American Avocet	June 1 (4); June 5, 6	Rare; Yes—June 21
Wilson's Phalarope	May 19 (2); May 20, 23	Common; Yes
Northern Phalarope	May 19 (50); May 22, 23	Common; —
Her. Gull (?Cal-CSH)	May 1 (2); May 2,10; May 20	Rare; No
Franklin's Gull	May 2 (2); May 3	Rare; No
Bonaparte's Gull	My 2 (20); My 10, 20; My 25	Rare; No
Black Tern	May 24 (500); May 25, 29	Common; Yes—June 13
Great Horned Owl	Present in winter	Common; Yes
Snowy Owl	Feb. 3 (2); Feb. 13; June 10	Rare; No
Longeared Owl	April 18 (1); April 22, 25	Common; Yes—May 27
Saw-whet Owl	Jan. 10 (1); Jan. 21; June 1	Rare; No
Whip-poor-will	June 4 (1)	Rare; —
Common Nighthawk	June 4 (2); June 5, 7	Rare; —

Species	Date first seen (number); next two dates; last date	Occurrence; Breeding?
Belted Kingfisher	May 8 (1); May 9	Rare; No
Yellow-shafted Flicker	May 1 (4); May 4, 10	Common; Yes—May 28
Red-shafted Flicker	May 1 (2); May 3, 11	Rare; Yes—June 15
Eastern Kingbird	May 17 (6); May 19, 24	Common; Yes—June 28
Horned Lark	March 18 (1); March 20, 30	Common; Yes—May 28
Tree Swallow	May 16 (2); May 17, 19	Rare; No
Barn Swallow	May 17 (2); May 20, 22	Common; Yes
Common Raven	March 28 (3); March 31	Rare; No
Common Crow	April 2 (6); April 6, 15	Common; Yes—May 20
Blk.-capped Chickadee	Jan. 25 (4); Jan.30, Feb.9,10	Rare; No
W.-breasted Nuthatch	My 10 (1); My 14, 18; My 21	Rare; No
House Wren	May 17 (4); May 20, 23	Rare; Yes
Winter wren (Error-H)	June 10 (2); June 14, 19	Common; Yes—June 27
Catbird	May 29 (2); May 30, June 11	Common; Yes
Robin	April 6 (1); April 7, 10	Common; Yes
Brown Thrasher	May 16 (4); May 18, 20	Rare; —
Swainson's Thrush	May 10 (2); May 11, 15	Rare; No
Northern Shrike	April 12 (1); April 14, 20	Common; Yes—June 4 (Loggerhead—CSH)
Yellow Warbler	May 17 (4); May 20, 24	Common; Yes
Myrtle Warbler	My 4 (25); My 5, 7; My 15	Common; No
Blackpoll Warbler	May 24 (2); May 27, 30	Rare; —
Yellowthroat	May 25 (2); May 27, 30	Rare; Yes
American Redstart	May 17 (1); May 18, 24	Rare; —
Bobolink	June 10 (2); June 12, 15	Rare; Yes
Western Meadowlark	April 10 (1); April 12, 24	Common; Yes
Yellow-hd. Blackbird	Apr. 22 (1); Apr. 24, May 2	Common; Yes—June 10
Red-winged Blackbird	May 1 (25); May 2, 3	Common; Yes—June 3
Brewer's Blackbird	Apr. 26 (10); Apr. 27, May 1	Rare; No
Common Grackle	May 1 (100); May 2, 3	Common; Yes
Brown-hd. Cowbird	May 1 (12); May 2, 11	Common; Yes
Rose-b'sted. Grosbeak	May 17 (2); May 24, 25	Rare; —
Evening Grosbeak	Feb. 1 (10); Mar.2,15; May1	Rare; No
Pine Grosbeak	Jan. 10 (12); Jan. 15, 27; Jan. 29	Common; No
Purple Finch	My 4 (100); My 5, 7; My 15	Common; No
Common Redpoll	Ap. 2 (8); Ap. 3, 10; Ap. 20	Rare; No
Rufous-sided Towhee	May 10 (1); May 12, 17	Common; —
Lark Bunting	May 1 (2); May 2, 8	Rare; —
Slate-colored Junco	Apr. 14 (10); April 16, 21; Apr. 30	Common; No
Tree Sparrow	Apr. 6 (2); Apr. 8, 20	Common; Yes (Error—CSH)
Harris' Sparrow	My 14 (2); My 15, 16; June 2	Common; No
W.-crowned Sparrow	May 5 (20); May6,7; May 29	Common; No
W.-throated Sparrow	May 5 (1000); May 6, 8	Common; —
Swamp Sparrow	May 4 (12); May6,8; May19	Rare; No
Song Sparrow	May 4 (12); May6,9; May15	Rare; No
McCown's Longspur	May 5 (10000); May 6, 8; May 31	Common; No—very bad on crops
Lapland Longspur	May 8 (1000); May 9, 15; May 30	Common; No—very bad on crops
Cht.-collared Longspur	May 7 (25); May 8, 9	Common; Yes—June 26
Snow Bunting	Jan. 1 (100); Jan. 2, 5; May 20	Common; No

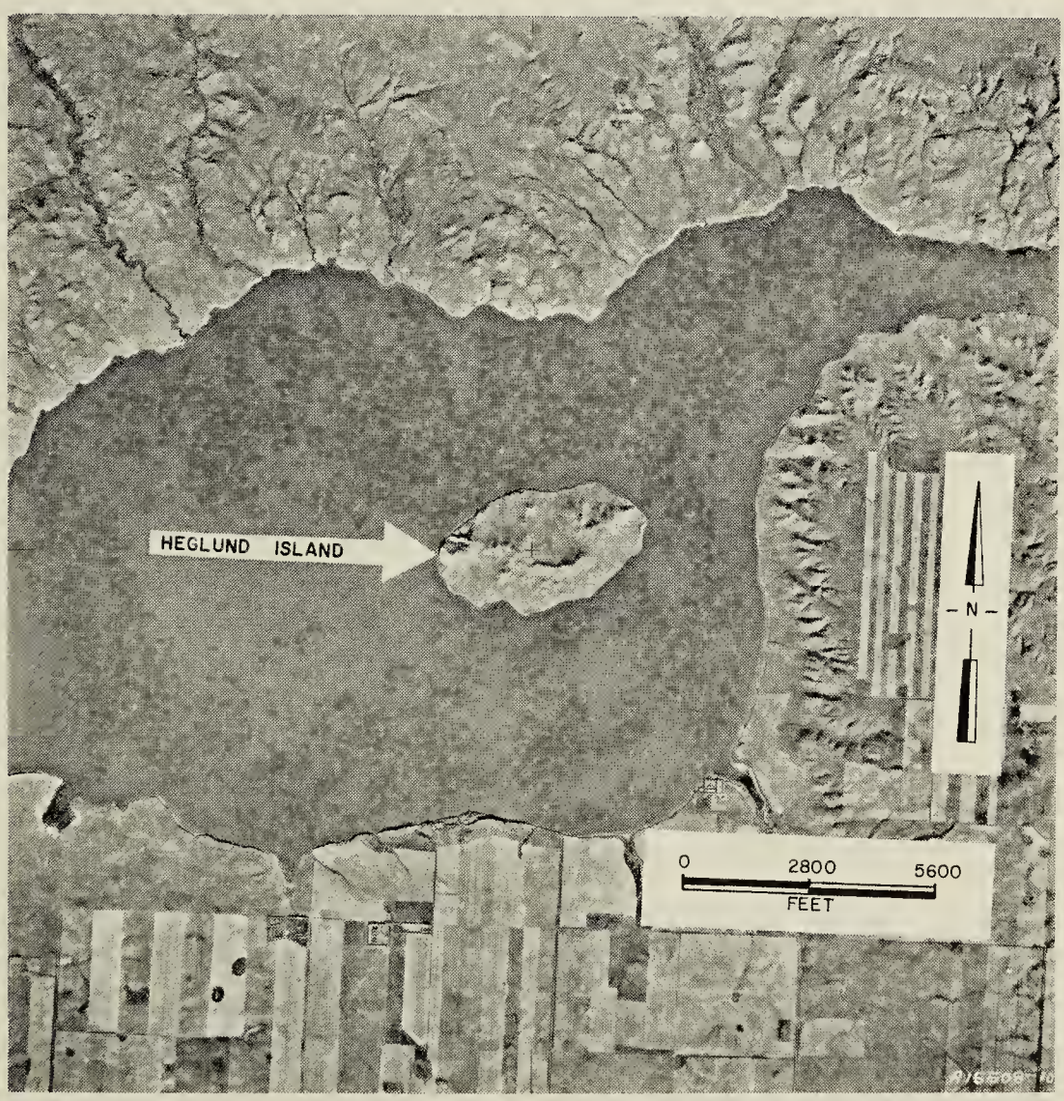
SOME ASPECTS OF THE NESTING OF DOUBLE-CRESTED CORMORANTS AT CYPRESS LAKE, SASKATCHEWAN, IN 1969; A PLEA FOR PROTECTION

by **Kees Vermeer,** Canadian Wildlife Service, Edmonton

During April and May, 1969, I visited 210-acre Heglund Island in Cypress Lake, 49° 28′ N; 109° 28′ W, in extreme southwestern Saskatchewan (Fig. 1). The island is hilly with its highest point about 150 feet above the lake and consists chiefly of open meadow with greasewood bushes at the southwest tip and gooseberries and sagebrush at other locations. The nearest distance from the island to the mainland is about 2400 feet.

White-tailed jack rabbits were observed at various times and a dead striped skunk was also found. These animals may have arrived on the island from the mainland by crossing the ice in the winter. Approximately 40 head of cattle were introduced on the island in the second half of May.

Ninety nests of Canada Geese were found widely distributed over the island. Several pairs even nested on the hilltops. Thirty-seven nests of Mallards and two nests of American Widgeons were found. The nests of Mallards, like those of the geese, were widely distributed over the island and several nests were on the hilly ridges. Three nests of that species were observed in concealed earth fissures caused by slumping near the shore.



Canadian Government Photo

Fig. 1. Air photo of Heglund Island in Cypress Lake

Passerines such as Bank Swallows, Brewer's Blackbirds, Red-winged Blackbirds and Vesper Sparrows nested on the island.

Colonies of California Gulls, Ring-billed Gulls, White Pelicans and Double-crested Cormorants were also present. Although 12 clutches of White Pelicans were initiated, they were deserted later on.

Nesting Pattern of Cormorants

The cormorant colony, with its 434 nests, is the largest of 10 colonies of this species in Saskatchewan (Vermeer, in press). The cormorant nests were separated from the insular meadow by greasewood bushes. During the first visit to Cypress Lake on April 17, the island could not be reached as the lake was covered with ice. From the mainland, between 100 to 200 cormorants could be observed occupying the nesting area on that date. The cormorants started egg-laying soon after as 35 clutches with one and three clutches with two eggs were counted on April 24. On April 30 there were 68 clutches with one egg, 36 with two, 16 with three, 15 with four and 1 with five eggs. The colony

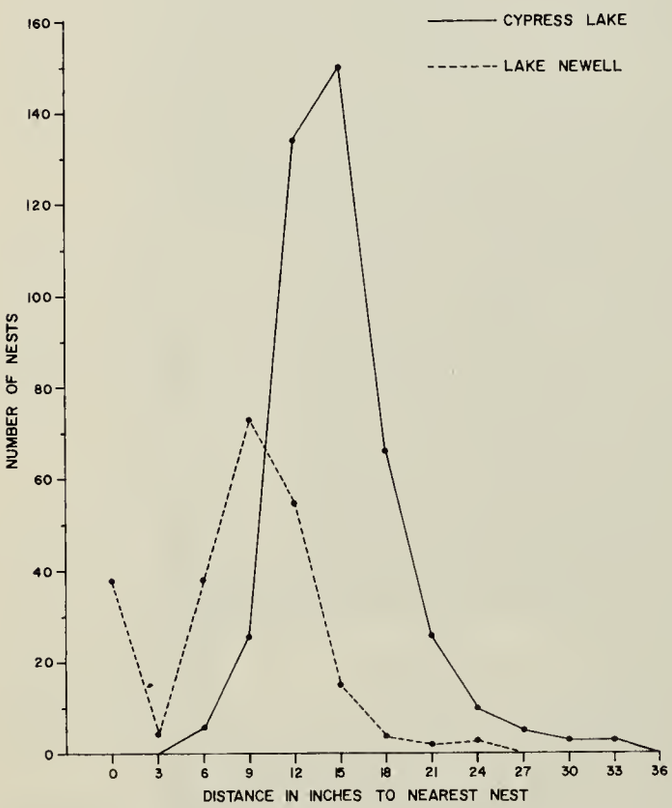


Fig. 2. Distribution of distances between Double-crested Cormorant nests at Cypress Lake and Lake Newell.

was made up of four nesting nuclei. These nuclei consisted of 42, 144, 166 and 82 nests and were separated from one another by distances of 10, 24, and 8 feet respectively. On April 24, the distances between the rims of each nest and its nearest neighbour were measured to the nearest three inches for the purpose of learning more about the nest distribution of the cormorants. The distances between nests were also measured in a cormorant colony with 232 nests on a three-acre island in Lake Newell, 50° 24′ N; 111° 58′ W, Alberta in 1969 for comparison with those at Cypress Lake (Fig. 2). The mean nesting distances for cormorants at Cypress Lake and Lake Newell were 14.98 and 8.48 inches respectively. The difference between those mean distances was statistically significant ($P < 0.01$). The nests at Lake Newell were approximately three or four times taller than those at Cypress Lake, possibly reflecting a longer established colony. It can be seen that 38 nests at Lake Newell, which were among the tallest structures, were attached to one another (Fig. 2). Although attached, they may have been initially separated as observed for recently built, low nests in that colony. An increment in nesting height leads to the accumulation of nesting material which may give rise to several massive supporting structures with many nest bowls each (Fig. 3). Hence, the smaller nesting distance of cormorants at Lake Newell may be related to taller nests which in turn may be the result of colony age and/or climatic conditions favouring the preservation of nesting platforms.

The Clark-Evans (1954) method was used to test whether the observed distribution of cormorant nests at Cypress Lake and Lake Newell departed from a random distribution. The distribution of nests at both colonies showed a highly significant deviation from randomness in the direction of aggregated spacing ($P < 0.01$). In five cormorant colonies ranging from two to five nests in the Canadian prairie provinces, I observed

Fig. 3. Nests of Double-crested Cormorants at Lake Newell, Alberta

that cormorants also nested in an aggregated pattern like those at Cypress Lake and Lake Newell. The reason why cormorants nest in an aggregated pattern is unknown. Perhaps it is an anti-predator device directed against avian predators such as gulls and crows. California Gulls were observed to prey on the cormorant eggs between the time period when I left the colonies and the return of the cormorants to their nesting sites. Drent and Guiguet (1963) report crows to be extensive predators on eggs and young of cormorants in British Columbia in similar situations. Crows and gulls may have less opportunity to take eggs and recently hatched young than when the nests of cormorants would be more dispersed.

Plea for Protection

The number of breeding cormorants at Cypress Lake made up more than one-third of the total breeding population of cormorants in Saskatchewan (Vermeer, in press). This, plus the fact that the 90 breeding pairs of Canada Geese may constitute one of the largest concentrations of insular nesting geese in Saskatchewan, may be justification for urging special protection for the nesting island. As the island is 210 acres in size it can provide the public with unique opportunities to observe those species in their natural environment with minimal interference. If cattle could be barred and indiscriminate motor-boat landings prohibited, the pelicans might start a more successful and permanent colony than that observed in 1969. Since the island is owned by the province of Saskatchewan, now leased to a rancher, it should be possible to acquire the area without much financial cost.

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A BIRD LIST FOR THOMPSON, MANITOBA

by **Joseph W. Johnson,** Black Diamond, Alberta

EDITOR'S NOTE: Joe Johnson, formerly of Nova Scotia, has been an active birder for a number of years. In recent years he contributed more than 800 nest records to the Maritimes Nest Records Scheme. As a result of a nine-month stay at Thompson he has made a worthy contribution to the knowledge of birds in this still remote part of Manitoba.

Although Thompson is the third largest city in Manitoba (second only to Winnipeg and Brandon), with a population of more than 20,000, no previous list of birds for the area has come to our attention. Thompson, which is more than 400 miles north of Winnipeg and within the Nelson River drainage system, lies within a vast region that is poorly known ornithologically.

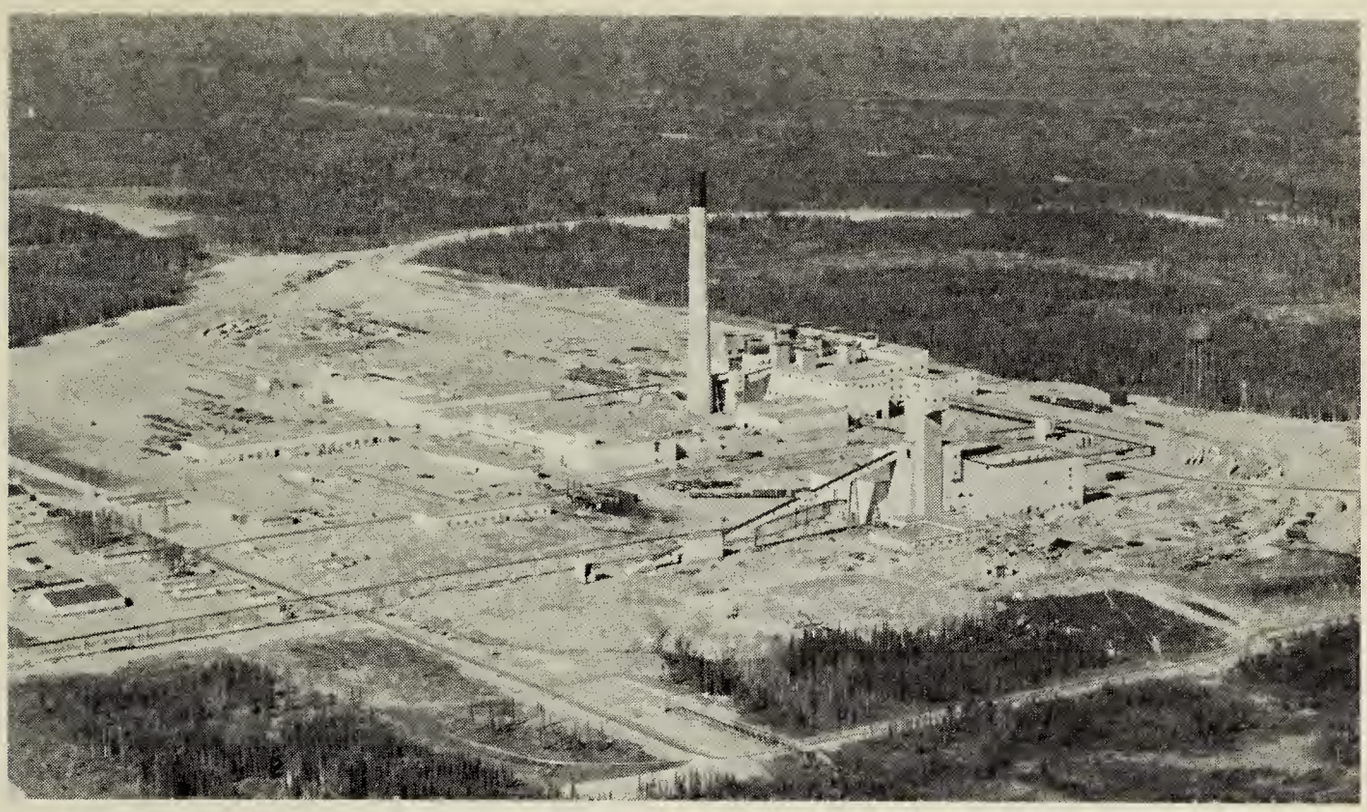
The nearest points for which published records are available are Thicket Portage, 30 miles south, and Pikwitonei, 30 miles east-southeast. Observations were made at Thicket Portage by a party led by P. A. Taverner in August 1936 (W. E. Godfrey, Nat'l Mus. Can. Bull. No. 128, pp. 1-52, 1953). H. W. R. Copland in 1949 and again in 1950, accompanied by G. J. Smith, recorded species in the Pikwitonei area for brief periods in the summer season (Nat. Hist. Soc. Manitoba Newsletter, 1963, Nos. 3 & 4). Twenty-one of 88 species reported at Thicket Portage and 13 species reported at Pikwitonei were unrecorded at Thompson. However, 38 additional species were observed at Thompson by Johnson. Two other species were recorded at Thompson by T. Lindsey. The combined lists include about 130 species.

Some of Johnson's records are of special interest in providing or suggesting range extensions, and verifying data; see, for example, Red-breasted Nuthatch, Magnolia Warbler, Ovenbird, Red-winged Blackbird, Purple Finch, Pine Siskin and Vesper Sparrow. Perhaps his most interesting observation is that of a large flock of Long-tailed Jaegers evidently blown inland from the Churchill region by an unusual storm. This is an unprecedented inland record for this species.

All the observations that I am going to report in this paper, unless otherwise noted, were made within three miles of the centre of Thompson. The city itself comprises only a small part of the six-mile-diameter circle which constituted the area of my study. Observations were made between November 13, 1968, when I arrived in the city, and August 10, 1969, when I left. The area is generally quite flat and forested. There is one small lake which is essentially dead owing to chemical pollution, and a fairly large river. About one-third of the area is settled or has been cleared. Muskeg forest takes up less of the area than upland forest. There is very little open muskeg. Black spruce is by far the commonest tree species, aspen and jack pine being next. Several patches of black spruce remain within the city. The inadvertent creation of several ponds in one area provided good habitat for a number of species, this being the only place where I found Redwings, Soras, several duck species and most of the Grackles. In contrast to many lakes in northern Manitoba there was no large growth forest around the lake and no new species were found there.

I saw or heard at least 104 species in the area, 103 of which were definitely identified. I believe at least 50 species bred there in 1969. With 17 species, the evidence was conclusive—nests with eggs or young, or young broods; with the rest I went mostly by degree of abundance and singing during the nesting season. Chipping Sparrows were the commonest nesters. I saw a number of young with parents in July and August, more than in the case of any other species. The same goes for the amount of singing heard, and the number of old nests found, which totalled at least a dozen. They were found chiefly in the coniferous forest, only coming into the city where there were patches of conifers. Probably only five or six species nested within the city, including Chippies. The nesting season was quite short. I saw no evidence of second nestings of any species.

Three snowstorms, associated with unseasonably cold weather and north winds on May 18, May 27 and 28, and June 11 and 12, strange as it may seem, appeared to bring in migrants from the south. As soon as the weather cleared after each storm, and before the wind had shifted, or much warming had taken place, numbers of migrants were evident, especially of species which had not yet appeared in the area, including some close to the



Manitoba Government Photo

Smelter at Thompson

northern known limit of their breeding range. The June storm, with winds stronger than the other two, also apparently brought birds that nest farther north. This storm probably accounted for the Fox Sparrows, White-crowned Sparrow, Harris' Sparrows, Long-tailed Jaegers, Rough-legged Hawk, Water Pipits, the three species of migrating shorebirds, and some of the Horned Larks and Lapland Longspurs that appeared on June 13 and later. It is very unusual, for example, to see Long-tailed Jaegers so far south and inland. Perhaps Purple Finches and Solitary Vireos would have bred in the area, but were wiped out in the long, fierce June storm. I found four dead small birds of three species after the May 27-28 storm. The six inches of snow deposited by the June storm took several days to melt and must have had a disastrous effect on duck nests.

I was surprised at the absence or near-absence of Common Loons, Canada Geese, Spruce Grouse and Palm Warblers. Heavy shooting pressure in the spring and autumn may have accounted for the apparent absence of Spruce Grouse and the scarcity of Ruffed Grouse. There was little or no shooting during the nesting season, so probably the local duck breeding population was not much affected by gunners.

Species List

COMMON LOON. One each on July 12 and 31.

MALLARD. Fairly common in May and June, uncommon in July. First seen for certain April 25 (saw the first ducks on April 24, unidentified, probably Mallards); saw one brood.

GREEN-WINGED TEAL. Common. First seen April 25; found one occupied nest, May 30, incubating, and one brood; flock of 30 on August 4.

BLUE-WINGED TEAL. Seen three or four times in June and end of May, starting May 29, up to three at a time.

AMERICAN WIDGEON. Fairly common. First seen May 29; probably breeding.

SHOVELER. Rather uncommon. First seen May 31, last seen June 30 (a pair); may have bred sparingly.

RING-NECKED DUCK. Rather uncommon. First seen May 29; probably breeding.

(LESSER SCAUP?). Three ducks seen in poor light on April 25 seemed to be of this species.

COMMON GOLDENEYE. Rather uncommon. First seen May 21; found one occupied nest, June 14, incubating.

BUFFLEHEAD. A pair on May 6, two females each on June 5 and July 14.

(HOODED MERGANSER?). Saw in the distance what appeared to be a male of this species on June 24.

COMMON MERGANSER. One each on May 8, June 26, July 12.

GOSHAWK. One on January 19.

RED-TAILED HAWK. Two on May 6, one on May 8.

ROUGH-LEGGED HAWK. One on June 13.

MARSH HAWK. One on June 15.

(PIGEON HAWK?) One may have been seen twice in June and July, but identity not certain.

SPARROW HAWK. Fairly common. First seen April 25; almost certainly breeding; saw a pair mating.

SPRUCE GROUSE. T. Lindsey reported four seen, January 1, 1964 (Nat. Hist. Soc. Manitoba, Newsletter 1964 No. 1, p. 12) (Ed.).

RUFFED GROUSE. Uncommon. Present both winter and summer; saw one brood.

WILLOW PTARMIGAN. Saw one December 20; in spring found wings and feathers at several places and one intact dead one. T. Lindsey saw this species on six occasions in the Thompson region during the winter of 1965 (Nat. Hist. Soc. Manitoba Newsletter 1965, No. 1, p. 3) (Ed.).

SHARP-TAILED GROUSE. Four on April 20.

SORA. Fairly common in one area. First heard May 17; only *seen* once; very likely breeding.

SEMIPALMATED PLOVER. Two on May 31, one each on June 13 and 14.

KILLDEER. Common. First seen April 20; very likely breeding.

COMMON SNIPE. Fairly common. First noted (heard) April 30; found one occupied nest, June 30, incubating.

SPOTTED SANDPIPER. Common. First seen May 29; found one occupied nest, July 6, incubating.

SOLITARY SANDPIPER. Fairly common. First seen May 17; very likely breeding.

GREATER YELLOWLEGS. Heard one on May 3, saw one on May 17.

LESSER YELLOWLEGS. Uncommon in May, June, July. First noted for certain May 29, but I heard what I believe was one of this species on May 12, and saw and heard what I believe was one on May 17; probably bred sparingly.

LEAST SANDPIPER. Rather uncommon from May 31 till June 13; five also seen on July 14.

SEMIPALMATED SANDPIPER. One on June 13, three on June 14.

LONG-TAILED JAEGER. A flock on and near Burntwood River June 13 to June 27, largest number seen: 27 to 29 on June 14; very long central tail feathers and all other marks distinguishing the species from Parasitic Jaeger clearly noted. Activities included swimming in loose groups, resting on land in loose groups up to one-tenth mile from water, flying, and one day, apparently, flycatching. They stayed in a rather small area generally, but on four occasions one or two were seen about a mile away and some distance from the Burntwood River at Thompson flying over woods and roads.

HERRING GULL. Abundant in May and June, uncommon in July. First seen April 20; apparently didn't breed close to Thompson.

RING-BILLED GULL. T. Lindsey recorded 300 on April 30, 1964 (Nat. Hist. Soc. Manitoba, Newsletter 1964, No. 2, p. 23) (Ed.).

COMMON TERN. Many at Paint Lake, 20 miles south of Thompson, on July 29, apparently nesting. Two unidentified *Sterna* terns at Thompson, June 16.

ROCK DOVE. Two on June 28.

MOURNING DOVE. One on May 17.

BLACK-BILLED CUCKOO. H. Hosford heard one calling on June 15, 1966 in deciduous woods on the Burnt-

wood River just north of Thompson (pers. comm., 1969, Ed.).

GREAT HORNED OWL. Heard two on March 23, saw and heard one May 21, saw one July 31; probably breeding.

GREAT GRAY OWL. T. Lindsey recorded two in late December, 1965 (H. Mossop, "Chickadee Notes" No. 574, Wpg. Free Press, January 15, 1966) (Ed.).

BOREAL OWL. Saw one on July 28, perhaps a juvenile.

COMMON NIGHTHAWK. Common. First seen June 3; very likely breeding.

BELTED KINGFISHER. Rather uncommon. First noted (heard) April 29; found one new nest tunnel being excavated in June, earth around it fell away before it was completed.

YELLOW-SHAFTED FLICKER. Rather uncommon. First noted (heard) April 27; very likely breeding.

YELLOW-BELLIED SAPSUCKER. Uncommon. First noted (heard) on May 30; May 31, drilling nest cavity (later saw young).

HAIRY WOODPECKER. One each on February 8, March 25.

BLACK-BACKED THREE-TOED WOODPECKER. Saw a female close to a newly excavated woodpecker nest cavity on June 30, no sign of life at nest on later visits; also saw one each, June 13, July 26.

NORTHERN THREE-TOED WOODPECKER. One each on May 12, August 4.

EASTERN KINGBIRD. Heard one on June 27.

EASTERN PHOEBE. Saw one May 6, heard one June 13.

YELLOW-BELLIED FLYCATCHER. Heard one on June 7.

TRAILL'S FLYCATCHER. Rather uncommon. First seen June 7; probably breeding.

LEAST FLYCATCHER. Uncommon. First noted June 1 (heard); found one occupied nest, June 27, laying.

OLIVE-SIDED FLYCATCHER. Heard one on June 7.

HORNED LARK. Common from May 14, when first seen, till June 17, when last seen. Strictly a transient.

TREE SWALLOW. Common. First seen May 1, saw a number of them near two bird boxes in July; very likely breeding.

BANK SWALLOW. Uncommon. First seen May 31; apparently doesn't breed close to Thompson.

BARN SWALLOW. Rather uncommon. First seen June 13; probably breeding.

CLIFF SWALLOW. Fairly common. First seen June 13. Found nine occupied nests (all separate except for two stuck together) on houses in one area of the city, all with large young, late July and early August. (Large flock of all four species of swallows, mainly Tree and Bank, on June 13, no doubt migrating.)

GRAY JAY. Uncommon from February till August; not seen before February; one carrying nesting material on April 6.

BLACK BILLED MAGPIE. T. Lindsey reported two in late December 1964 (Nat. Hist. Soc. Manitoba Newsletter Supplement, Christmas Bird Count 1964). The species was present at the Thompson garbage dump until February 13, 1965, when five were noted by him (Nat. Hist. Soc. Manitoba Newsletter 1965, No. 1, p. 4) (Ed.).

COMMON RAVEN. Abundant in winter, common in spring and summer; found one occupied nest, June 3, with feathered young.

COMMON CROW. Common. First seen April 12; found one occupied nest, June 1, incubating.

BLACK-CAPPED CHICKADEE. Two on April 6; uncommon from late May till early July; *never* heard whistled "phoebe" call.

BOREAL CHICKADEE. Uncommon in winter; not noted in April and most of May; rather uncommon May 23 to August.

RED-BREASTED NUTHATCH. Heard one approximately three times in June and late May, starting May 30.

BROWN CREEPER. One May 12.

AMERICAN ROBIN. Fairly common. First seen April 24; found two occupied nests: one June 19 being built; one July 23 with feathered young.

HERMIT THRUSH. Rather uncommon. First seen May 23; probably breeding.

SWAINSON'S THRUSH. Rather uncommon. First seen May 29; a wave of migrants passed through at end of May and beginning of June; probably breeding.

GOLDEN-CROWNED KINGLET. Uncommon in July, first seen June 30; perhaps bred sparingly.

RUBY-CROWNED KINGLET. Common. First noted (heard) April 30; very likely breeding.

WATER PIPIT. One or two on May 30 (I believe I heard a few during the week or two before that also), one on May 31, small flock on June 13.

CEDAR WAXWING. Two on July 26.

NORTHERN SHRIKE. One on April 30.

COMMON STARLING. Seen three or four times: two on May 6, two or three on May 31, flock of approximately 12 on July 2.

SOLITARY VIREO. Heard singing approximately four times (seen also) starting May 31, ending June 9 —no more after bad snowstorm of June 11 and 12.

RED-EYED VIREO. Rather uncommon. Singing from late June onwards; first noted (heard) June 27; very likely breeding.

TENNESSEE WARBLER. Rather uncommon. First seen June 7; very likely breeding.

ORANGE-CROWNED WARBLER. Rather uncommon. First seen June 1; very likely breeding.

YELLOW WARBLER. Fairly common till mid-July, scarce or absent thereafter; first seen June 5; found two occupied nests: one June 27, incubating, one July 1, laying.

MAGNOLIA WARBLER. Rather uncommon. First seen June 1; heard singing a number of times; probably breeding.

MYRTLE WARBLER. Common. First seen May 17; female carrying feather and scolding on June 7; very likely breeding.

BLACKPOLL WARBLER. One on May 30, four on June 13; apparently didn't breed in the vicinity of Thompson.

OVENBIRD. Uncommon. First seen May 31; heard singing at one spot several times and twice at another spot; very likely bred sparingly.

NORTHERN WATERTHRUSH. Rather uncommon. First seen May 29; very likely breeding.

WILSON'S WARBLER. Uncommon. First seen June 7; perhaps bred sparingly.

HOUSE SPARROW. Small numbers (less than 10) in one area of the city, both winter and summer (perhaps only two in winter—numbers appeared to increase in April); probably nested in one or two buildings.

RED-WINGED BLACKBIRD. Common in one marshy area with ponds; almost certainly breeding, once saw a female scolding frenziedly one of two yards from what appeared to be a Redwing nest (inaccessible). First seen April 30.

RUSTY BLACKBIRD. Three or four on April 25, two on May 29.

COMMON GRACKLE. Very common in one marshy area with ponds. First seen for certain April 25; very likely breeding.

(Unidentified blackbirds, presumably of this or the preceding species, heard on April 20, small flock seen April 21, flock of approximately 100 heard and glimpsed on April 25.)

PURPLE FINCH. Heard a male singing two or three times (also seen). First noted (heard) May 30; none noted after bad snowstorm of June 11 and 12.

HOARY REDPOLL. About five on March 17, two on March 23, two on *May* 29.

COMMON REDPOLL. Unidentified redpolls were rather uncommmon throughout the winter and spring,

last seen May 31; presumably the majority were of this species, but only definitely identified one on February 23, approximately 10 on March 6. Generally redpolls were seen flying too far away for identification, or were just heard.

PINE SISKIN. Fairly common. First noted (heard) June 13; probably breeding.

RED CROSSBILL. Flock of approximately 30 and another (or some of same?) of 15 or more on August 4.

WHITE-WINGED CROSSBILL. Flock of approximately 30 on July 25; heard a few on July 23.

SAVANNAH SPARROW. Rather uncommon. First seen May 27, very likely breeding.

VESPER SPARROW. Found one occupied nest, June 27, apparently just finished laying; never saw any adults very far from this nest and never more than one at a time.

SLATE-COLORED JUNCO. Fairly common. First seen April 21; found two occupied nests: one June 24, one July 5, both incubating.

TREE SPARROW. Common from April 25, when first seen, till May 6, when last seen.

CHIPPING SPARROW. Very common. First seen May 14; found two occupied nests: one July 7, laying, one July 21, incubating.

(Glimpsed a few unidentified *Spizella* sparrows between May 6 and 14.)

HARRIS' SPARROW. Passed through in abundance for a week, starting May 19. First seen May 14, last seen June 1, except for a few on June 13.

WHITE-CROWNED SPARROW. Passed through fairly commonly from May 19, when first seen, till May 29, or 30, when last seen (also one heard on June 13); strictly a transient.

WHITE-THROATED SPARROW. Fairly common. First seen May 15. Very likely breeding.

FOX SPARROW. First seen May 19; a wave passed through on May 29; last noted May 31, except for four on June 13. Strictly a transient.

LINCOLN'S SPARROW. Very common wherever the habitat was right. First seen May 29; very likely breeding.

SWAMP SPARROW. Common wherever the habitat was right. First noted May 31 (heard); (*never* seen, just heard); very likely breeding.

SONG SPARROW. Rather uncommon. First seen May 6; found one occupied nest, July 3, incubating.

LAPLAND LONGSPUR. Passed through in abundance in May and June. First seen for certain May 20, last seen June 20 (large flock); (on May 15 saw large flock of birds that were probably Longspurs).

SNOW BUNTING. A number of flocks from last week in April till June 1. First seen April 2, last seen June 3.

courtesy Public Information Branch

Thompson, Manitoba

MIGRATIONS OF DIURNAL BIRDS OF PREY IN THE ROCKY MOUNTAIN FOOTHILLS WEST OF COCHRANE, ALBERTA

by **Dick Dekker,** 3819 - 112A Street, Edmonton

In the absence of marked topographic features which would tend to channel migrant raptors, these birds pass over Alberta along a wide front. Not even the Rocky Mountains, which in this region rise gently from the plains in a series of irregularly-formed foothills, have much influence in concentrating raptor movements. Nevertheless, there is an impressive migration in the foothills region.

My observations were made west of Cochrane, Alberta, on 83 days over a period of eight years, in both spring and fall and on several occasions during the summer and winter (Table 1). Cochrane lies about 30 miles east of the Rocky Mountains. The observation area is west of Cochrane on private ranch land where trespassing is unwelcome, hence the exact location of the study area is omitted. The lowest elevation of the area is about 3,500 feet. The area is traversed by the Bow River, which flows in an easterly direction. Its valley is about one mile wide. Along this valley, south-facing slopes are semi-arid and grass-covered as far west as Morley, while the hills to the south are largely forested. On the grassy slopes, Richardson's ground squirrels *(Citellus richardsonii)* form an abundant food supply for the following raptors that breed or spend the summer in the area: Goshawk *(Accipiter gentilis)*, Cooper's Hawk *(Accipiter cooperii)*, Red-tailed Hawk *(Buteo jamaicensus)*, Swainson's Hawk *(Buteo jamaicensus)*, Swainson's Hawk *(Buteo swansonii)*, Golden Eagle *(Aquila chrysaetos)*, and Prairie Falcon *(Falco mexicanus)*.

I have seen Goshawk, Golden Eagle and Prairie Falcon in every month of the year. All six of the above species are encountered from the last week of March until the middle of October. For this reason the counting of raptors in spring and fall does not give a true picture of the number of migrants. Another complicating factor is that many migrating raptors, especially the eagles, appear to stay in the area for some time, attracted by the abundance of ground squirrels. Therefore, I have rarely attempted to count individual birds, unless it was obvious that the raptors in question were migrating, as was the case with the fall flight of Sharp-shinned Hawks *(Accipiter striatus)* and sometimes with the eagles.

Techniques of Observation

As a rule my observations were made from the top of a high hill which allowed unobstructed view for many miles. The birds that I saw were travelling along a broad front. Observations were usually begun around 10:00 a.m. Even at that late time hardly any hawks or eagles were stirring in the hills, especially when it was calm, or when the wind was blowing from the east or the north. The prevailing wind is the Chinook, a strong westerly wind, which frequently gusts up to 50 miles an hour. When the Chinook blows, there are only a few clouds in the sky. This combination of strong winds and sunshine is typical of a good hawk-watching day. Usually, observation days lasted until late afternoon. When exceptionally strong and chilling winds forced me to lower levels, only part of the day was actually spent on the hill-top. Often I have forsaken counting of hawks to watch their behaviour instead. Remarks on food habits and hunting techniques in this paper are based on many observations.

To illustrate the difficulty of assessing the true number of migrating raptors in the area a complete account is given below for one day, which may be considered as average for the second half of March.

Table 1: Observation days, foothills west of Cochrane, Alberta.

year	number of days in spring			number of days in fall		
	March	April	May	Sept.	Oct.	Nov.
1960	4	5		2	2	4
1961	4	6	1			
1964					1	2
1965		4			3	
1966	4	1		1	2	
1967	6	3	1	1		
1968	8	2			3	
1969	6	2		2	1	2
total	32	23	2	6	12	8

Notes on hawks and eagles seen on March 30, 1969:

The first two hours were spent driving west on highway 1A, starting at Cochrane. During frequent stops the countryside was scanned through binoculars. The remaining five hours were spent on foot. Figures in brackets refer to the number of observations of eagles, not to the actual number of individuals present in the country.

TIME Overcast with pale sun, light SE winds, ± 25° F.

1000 hrs.: *Ad. Bald Eagle* perched on tree close to river, (1).

1010: *Ad. Bald* on fence post (2).

Dark: *unidentified eagle* on distant hill (3).

1015: *Ad. Golden Eagle* on fence post. I watched this bird for about 1 hour, during which time it took flight four times and attempted to catch ground squirrels (4). Two other *ad. Golden Eagles* on distant hills. (5- 6)

1030: *Imm. Golden* circling over fields to the west (7). When an *ad. Bald* (8) flew by, from west to east, the imm. Golden stooped at it three times. The Bald reacted in the usual manner by executing a swift roll and presenting the outstretched legs at the right moment. Both birds disappeared from view.

1040: *Imm. Golden* flew by and disappeared eastward (9). I left this observation point.

1130: Overcast, no wind, 30° F. *Golden Eagle* on hill side (10). Another on tree (11).

1200: I hiked into the hills. *Ad. Golden* flew by (12).

1210: *Ad. Golden* on hill top (13).

1300: Installed myself on the top of a hill. Sky cleared, the sun came out and the wind picked up from the west, soon blowing at 25-35 mph.

1305: *Golden* gliding over opposite slope (14). (Number 13 still perched on same hill top.)

1310: Two *ad. Bald Eagles* soaring in the west at great altitude (15-16).

1315: Four *ad. Bald* and one *Golden* soaring in northwesterly direction and disappearing from view (17-21).

1320: Two *dark eagles* over hills to the east (22-23).

1330: Three *ad. Golden* and two *ad. Bald* soaring in northeast (24-28). Small *accipiter* (male Cooper's?) soaring north of me.

1340: *Ad. Golden* sailing low over slopes to the west (29).

13:50: *Imm. Bald* circling and gliding in northeasterly direction (30).

1400: I left hill top and walked down. *Ad. Golden* appeared behind me (31).

1405: *Ad. Bald* and *ad. Golden* circled over hills far to the southwest (32-33).

1415: *Ad. Bald* circling to the northwest (34).

1420: *Imm. Bald* and *ad. Golden* circling southwest of me (35-36). The next hour was spent in a sheltered area, away from the chilling wind. Temperature had risen to about 45° F.

1430: *Ad. Golden* soaring nearby (37).

1500: Red-tailed Hawk called and soared overhead.

1530: Hiked back to the look-out hill.

1610: Arrived on the top and glassed surrounding hill sides and sky. No eagles to be seen.

1630: Walked down. Prairie Falcon soaring and gliding far to the north.

1700: Arrived at car and drove back to Cochrane. *Ad. Bald* (38) flying over fields to the south and circling low over the road where a crow was feeding on car-killed ground squirrel. Several trucks and cars passed in quick succession. The eagle flew back in the direction it came from and perched on a tree.

Discussion of the above observations

A total of 38 eagles was observed, but some duplication is to be expected. Eagle no. 7 is probably the same as no. 9. No. 12 may be the same bird as no. 13, no. 31 as no. 33 and no. 32 as no. 34. Two immature Bald Eagles were seen. It is unlikely that no. 30, which disappeared from view behind a hill to the northwest of me, was the same as no. 35 seen in a southwesterly direction half an hour later. Yet the bird may have flown in a semi-circle. Often it is possible to identify certain individuals among eagles of one species and the same age group. Not so in this case.

Status of raptors observed in the area

GOSHAWK *(Accipiter gentilis)*: Regularly seen in spring and fall, but never numerous. Highest number of observations in one day: four on April 23, 1961.

SHARP-SHINNED HAWK *(Accipiter striatus)*: Definite migration in fall. Sighted at a rate of five to 15 birds a day from early September to the middle of October. Birds seen in the last two weeks are adults. At times they soar at great heights, but when the strong westerly winds blow, they wing their way through the valleys. Much less numerous in spring; none to five birds a day.

COOPER'S HAWK *(Accipiter cooperii)*: Occasionaly seen in spring and fall: none to two birds a day.

RED-TAILED HAWK *(Buteo jamaicensis)*: Though common in August and September I observed no distinct migration. Most breeding birds arrive in April (earliest date March 23, 1967) and leave in September, with an occasional bird moving through until the middle of October.

SWAINSON'S HAWK *(Buteo swainsoni)*: Summer resident, but less common than previous species. I observed no distinct migration.

ROUGH-LEGGED HAWK *(Buteo lagopus)*: Occasionally seen during spring and fall, less frequently than on the plains farther east.

FERRUGINOUS HAWK *(Buteo regalis)*: Only one observation of a single bird on April 29, 1961.

GOLDEN EAGLE *(Aquila chrysaetos)*: Scarce resident throughout the year. From mid-September to mid-October there is a marked increase in the number of eagles that hunt for Richardson's ground squirrels. It is difficult to count individuals because the same birds may be seen several times. On bright days small numbers of birds soar and glide in a southerly direction, but this movement is not restricted to the foothills. According to my records, Golden Eagles in fall migration are common in the mountains. (On October 4, 1968, 16 birds were seen moving south along a ridge near Rock Lake). They are also seen on the prairies east of Edmonton well into November.

Spring migration presents a different picture. I have no records of birds seen east of Edmonton during numerous observation days in March and April. During that time the foothills may be of special interest due to their relatively short winter. West of Cochrane, exposed slopes are rapidly stripped of snow by strong Chinook winds, and as a rule the ground squirrels are out in the first week of March, at the same time the eagles appear. But again, it is difficult to learn their exact number. From then until the end of April many birds spend a period of time in the area and hunt exclusively for ground squirrels. From day to day the number of eagles may change consid-

Painting by Dick Dekker

Immature Golden Eagle in characteristic low flight hunting ground squirrels

erably. Where one saw several adults the day before, only immatures may hunt along the slopes.

By the middle of March the number of eagles in the area is at times exceptional. On dull days they can be seen perched on hill sides, fence posts and trees. Their activity increases sharply as soon as the strong west wind starts to blow. Looking up at one bird it is common to see others on the move. Ofter the birds travel together in loose flocks at great altitudes. On March 18, 1961, within half an hour, twice a group of seven was observed; on March 19, 1967, within one hour, groups of five, four, and three, plus several singles; on March 24, 1967, groups of seven and five. The birds join each other to soar in a column of rising air. In long glides one follows the other to the next thermal current. Many birds travel at lower altitudes with steady wing beats, interrupted at times by sailing. These eagles may start to soar over a distant hill and either continue on their way north, or descend and start to hunt, in which case they may be seen and counted again. For these reasons numbers should be calculated with restraint. At the height of the spring migration, however, even conservative estimates can run as high as 50 birds a day.

BALD EAGLE *(Haliaetus leucocephalus)*: Regular fall migrant. From none to five birds seen daily in the first half of October. Scarce thereafter, when many Bald Eagles may still be seen migrating across the plains farther east. More numerous in spring. The first birds are seen in early March. Some appear to stay in the area for a length of time and are seen feeding on carrion and ground squirrels. Road-killed rodents may be often utilized. Migration reaches a peak around the middle of March and levels off to the end of April, with the last birds being immatures. A few outstanding records: a group of eight adults soaring together

on March 18, 1961; four adults on April 3, 1965, on March 15, 1969 and on March 30, 1969.

A male and a female are often seen together, indicating that some birds travel in pairs. Along the Bow River, downstream from Calgary, I have seen wintering Bald Eagles that were apparently paired with male and female regularly perching in the same trees. On March 28, 1965, an adult male and female were feeding together on a deer carcass near Whitecourt.

It should be noted that spring migration, as well as fall migration, is not restricted to the foothills, but it may start at an earlier date than farther east on the plains. My earliest record for migrating Bald Eagles for prairie east of Edmonton is March 30, 1967.

HARRIER (Marsh Hawk) *(Circus cyaneus)*: Observed during spring and fall, but less commonly than on the prairies farther east: none to five birds a day.

OSPREY *(Pandion haliaetus)*: Only three observations: April 29 and 30, 1961, September 19, 1967.

PRAIRIE FALCON *(Falco mexicanus)*: Breeds in the area. No migragration observed.

MERLIN (Pigeon Hawk) *(Falco columbarius)*: Scarce summer resident. Few observations in spring and fall.

AMERICAN KESTREL (Sparrow Hawk) *(Falco sparverius)*: Summer resident. Few observations in spring and fall.

Conclusions

Migrating raptors, west of Cochrane, Alberta, are not noticeably channelled by the Rocky Mountains, with the exception of Sharp-shinned Hawks during the fall, and Golden as well as Bald eagles during the spring. Especially in March the number of eagles is spectacular (up to 50 birds per day) and to my knowledge unique in North America. The total number of fall migrants seen at Hawk Mountain, Pennsylvania, from 1958 to 1967, averaged 34 for Golden and 39 for Bald eagles for the entire season (Newsletter no. 40, 1968, Hawk Mountain Sanctuary Association).

Eagles on spring migration appear in the study area in the first week of March, which is considered early and may be related to the relatively short winter in the foothills. Areas of semi-arid slopes, where snow disappears early due to frequent Chinook winds, extend north at least as far as the Yukon. These areas are also characterized by a relative abundance of wintering hoofed animals. In the study area, Golden Eagles hunt exclusively for Richardson's ground squirrels, whose reappearance from hibernation coincides with the start of the eagle migration. Also, Bald Eagles were seen feeding on ground squirrels, as well as on carrion.

Remarkable is the total absence of Broad-winged Hawk *(Buteo platypterus)*, Peregrine Falcon *(Falco peregrinus)* and Gyrfalcon *(Falco rusticolus)* that do migrate on the plains east of Cochrane.

Of special interest is the early date at which the eagles move back to the still solidly frozen north. Until their regular prey becomes available it is to be expected that they depend largely on carrion, such as winter-killed mammals, for food. As wolf-killing campaigns are often carried out as late as the end of March, it is inevitable that eagles will fall victim to poison baits. Several cases in Alberta and the Yukon have come to my attention. In wilderness areas of the Northwest Territories, the Yukon and Saskatchewan it has been the practice to place wolf baits on frozen lakes and rivers for various reasons. One of them is that after break-up the meat sinks and is disposed of "safely." Considering the amount of poisoning that has been carried out in Canada's North, as well as in parts of southern Canada and the western United States, where the eagles winter, I consider it nothing short of a miracle that as many eagles can still be seen as I had the privilege of seeing in the past seven springs.

GLAUCOUS GULLS AT PRINCE ALBERT, SASKATCHEWAN

by **E. D. Beacham,** Prince Albert

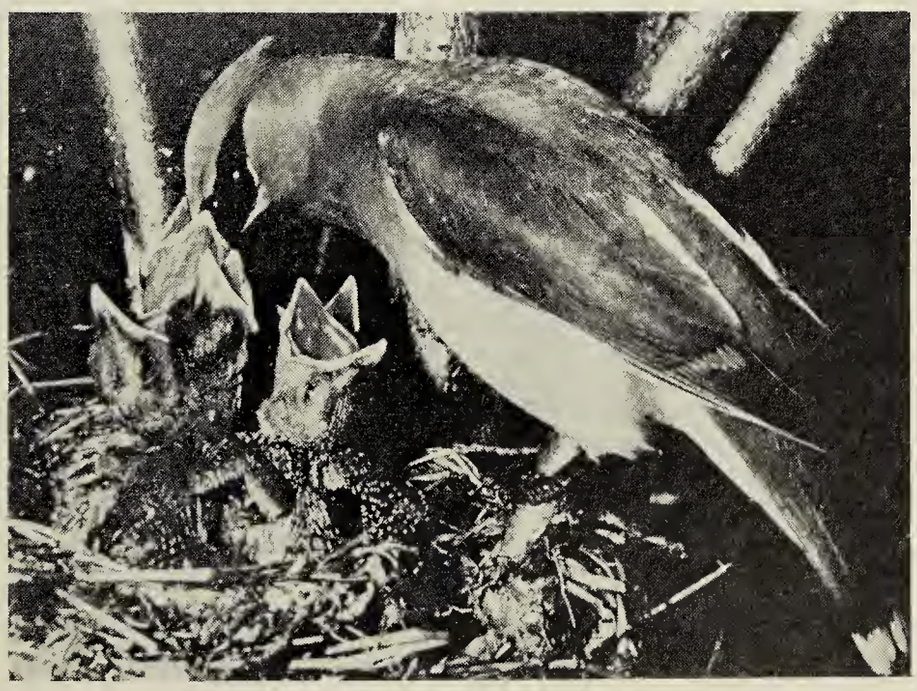
At about 4:30 p.m. on the afternoon of October 23, 1969, I observed a large gull with white wing tips flying north from the garbage dump on the grounds of the Saskatchewan Penitentiary at Prince Albert to the North Saskatchewan River. A check at the garbage dump the following morning, October 24, by my wife and myself, revealed the presence of two Glaucaus Gulls *(Larus hyberboreus)* both in the pale buffy first-year plumage. These birds were easily distinguished from the Ring-billed and juvenile Herring Gulls by their larger size and by their colour.

During the afternoon Mr. J. Norfield, my wife and myself, in company with Conservation Officer Ray Puddicombe, got permission from the Warden of the Penitentiary to drive into the garbage dump, and one of the gulls was collected and sent to the Saskatchewan Museum of Natural History, Regina. This constitutes the second specimen record for Saskatchewan, the first specimen having been taken by R. W. Nero at Lorado near Uranium City on June 13, 1960 (Nero. 1963. *Birds of the Lake Athabasca region, Sask.*). Two other sight records have been reported: one at Lake Athabasca on May 25, 1960, (Nero, *op. cit.*), and one on May 27, 1964 at Wollaston Lake (Nero, 1967. *The birds of northeastern Saskatchewan).* The Prince Albert record is the most southerly Saskatchewan record, being 400-450 miles south of earlier records.

The remaining Glaucous Gull was seen again the following morning, October 25, by my wife and me, and again the same afternoon by myself, Dr. R. Austin and Mr. Frank Morton of Prince Albert.

It is interesting to speculate on the reason for the occurrence of this Arctic gull as far south as Prince Albert. It may be of significance that their arrival coincided with a snow storm which hit central Saskatchewan on October 20. Other recent observations of the Glaucous Gull at this latitude in the Prairie Provinces are from Beaverhills Lake, Alberta, May 14, 1966 (Smith, *Blue Jay*, September 1967) and The Pas, Manitoba, October 15, 1946 (Waller, *Blue Jay*, September 1967).

AWARD WINNER, MANITOBA PROVINCIAL EXHIBITION, 1969



Color Photo by Chris Rees, Edmonton

Cedar Waxwing feeding her young

AN INVALID SASKATCHEWAN RECORD OF THE EUROPEAN WIDGEON

by **Mary Houston** and **C. Stuart Houston,** 863 University Drive, Saskatoon

The European Widgeon, *Mareca penelope*, is "recorded rarely but regularly, in North America (on both the Atlanic and Pacific coasts and in the interior . . . " After this statement, the 5th A.O.U. *Check-list*, published in 1957, mentions the localities of, among others, Great Slave Lake, Lake Winnipeg and southern Manitoba. The only authentic record for Alberta is an adult male collected at Valhalla Lake, April 27, 1959 (Salt and Wilk, 1966). Careful observation of male widgeons in spring should result in this species being added to the Saskatchewan list.

It was therefore of great interest to find, while checking the numerous instalments of "Official Canadian Record of Bird-Banding Returns", published in the *Canadian Field-Naturalist* from May 1924 to March 1932, a record of a banded European Widgeon recovered in Saskatchewan! In Vol. 43, p. 67, we read the following: "EUROPEAN WIDGEON, No. 386, 421, banded by E. W. Ehmann, at Lake Merritt, Oakland, Colifornia, on February 1, 1927, was shot on a slough on the NW 36, 1, 12, W3, Saskatchewan, near the International Boundary — reported on October 11, 1927." This location is five miles south and 15 miles east of Masefield, Saskatchewan. This appeared to represent the first valid record of the European Widgeon for Saskatchewan. The May 1929 issue listed another European Widgeon, No. 601,079, banded by Ehmann on December 15, 1927 and shot 18 miles northwest of St. Andrew's Mission, Atikameg, Alberta in May 1928, and this seemed to be the first Alberta record for this species.

One possibility of error still had to be excluded. In Coues' authoritative "Key to North American Birds", published in 1884, two alternative names were listed for the American species, *Mareca americana*, with "American Widgeon" listed first in preference to "Baldpate." Sportsmen tended to use the former name while ornithologists followed the first four A.O.U. *Check-lists*, beginning in 1886, in using Baldpate. (Only with the 5th A.O.U. *Check-list* in 1957 did the name officially become American Widgeon). The European species, which occasionally wandered down along the coasts of this continent, was listed by the A.O.U. in 1886 and 1895 simply as "Widgeon" but thereafter as "European Widgeon." Had there been some confusion in Ehmann's use of the term, "widgeon"? This seemed somewhat less likely when we noted that some of Ehmann's other recoveries were listed as "Baldpate."

The next step was to enlist the help of Mrs. Enid K. Austin an Oakland, California bander who once lived near Punnichy, Saskatchewan. She replied that Ehmann was known as a conscientious, careful worker unlikely to make an error in identification. She arranged for Paul Conel and Henry Childs, Sr. to check Ehmann's original banding records which were all present except for the 1927 book which was out on loan! This book was recalled and finally the original record was consulted. Band No. 386,421 on a bird later shot by a Mr. J. A. Underwood in Saskatchewan, was listed as a "female Widgeon." Without a qualifying adjective, at that time this would have referred to the American Widgeon or Baldpate, not to the European species.

Presumably a clerk in the banding office, or someone working for the *Canadian Field-Naturalist*, not realizing that "Widgeon" and "Baldpate" could be synonymous, and for the American species of Widgeon, must have added the prefix "European." Our common American Widgeon or Baldpate, that breeds in Saskatchewan, usually winter in California and the countries around the Carribean, so this 1927 record is merely an unexciting recovery of an American Widgeon—not a new species for the provincial list after all.

TWENTY-EIGHTH ANNUAL SASKATCHEWAN CHRISTMAS BIRD COUNT, 1969

Compiled by **Mary Houston**, 863 University Drive, Saskatoon

The twenty-eighth annual Christmas Bird Census was held between Dec. 20 and Jan. 1. Thirty-three localities reported from Saskatchewan. Counts were also received from Edmonton, Alta. and Fort Smith, N.W.T. The weather over the count period was, in general, good which enabled and encouraged many people to get out.

Only one new species was added to the list this year — a Bufflehead seen in Regina on count day. This species had previously been recorded in 1960 at Regina, during the count period. This brings the total of species seen on count day for the 28 years to 113, with 6 additional species seen during count period.

Probably the most striking observation was that of 19 Bald Eagles at Squaw Rapids in the Nipawin-Squaw Rapids count. Incidentally, only one other area reported this species and that as an additional.

The ubiquitous House Sparrows and Black-billed Magpies were each reported from 31 of the 33 localities, while Common Redpolls were seen in 28.

Sixteen species of water birds were reported—mostly from the Regina area where the Wascana Waterfowl Park enables many water birds to winter. Mallards, however, were reported in 10 areas.

Pine Grosbeaks were more commonly seen than usual (16 of 33 areas) while Bohemian Waxwings were considerably less common (only 9 of 33 areas).

ABERDEEN - SMUTS, Dec. 27. 51 miles by car in 2½ hours; temp. +6°; wind NE 9 mph; overcast. 8 species, 731 individuals.—Dr. and Mrs. J. B. Gollop.

BANGOR, Dec. 25. 30 miles by car; temp. +12°; calm; sunny; 2-3 inches of snow. 8 species, 525 individuals. Mrs. A. Thompson. Additional species seen during count period: Sharp-tailed Grouse, 7, Dec. 24.

BROADVIEW, Dec. 28. 63 miles by car; temp. +8°; calm, 9 species, 355 individuals. D. G. Francis, Johnnie Fuchs.

CRAVEN, Dec. 21. 74 miles by car and 3½ miles on foot in 5 hours; temp. –5° to 0°; wind 5 mph; partly overcast; 1 inch of snow. 7 species, 444 individuals. Greg Bobbitt, Eric Cooke.

CUMBERLAND HOUSE, Dec. 31. 6 hours and 7 miles on foot, 6 hours and 25 miles by car, 14 hours and 32 miles by dog team; temp. 5° to 10°; wind NE 10 mph; overcast, snowing in a.m.; 6 inches of snow. 14 species, 208 individuals. Raymond Bisha, Stuart, David and Donald Houston, Stan and David Riome, Doug Whitfield.

DILKE, Dec. 28. 56 miles by car and 2 on foot in 3¾ hours; temp. +15° to 0°; wind N. 10 to 15 mph; partly cloudy; 6 inches of snow, drifted; 9 species, 1898 individuals. Boswell Belcher (compiler), Margaret Belcher, Mr. and Mrs. S. R. Belcher, Mr. and Mrs. Godfrey Carr. Additional species seen during count period: Golden Eagle, 1, Jan. 1; Slate-colored Junco, 1; Snow Bunting, Dec. 23, 24, 26.

ERINFERRY, Dec. 31. 9 species, 136 individuals. Mrs. E. A. Dodd. Additional species seen during count period: Mallard, 1, Dec. 20.

FORT QU'APPELLE, Dec. 20. Temp. 15°; calm; 4 inches of snow. 19 species, 276 individuals. Dr. and Mrs. G. D. Barnett, E. Manley Callin (compiler), Richard Carter, Mr. and Mrs. Errol Cochrane, Marjorie Davidson, Mr. and Mrs. Wm. Gray, Stanley Harrison, Ron Hooper, Johanna Kelly, Jack and Jay Lowe, Dick Nevard, John Norman, Horace Reed, S. P. Regan, Joe Rumancik. Additional species seen during count period: Canvasback, 2, Dec. 23; Red-breasted Merganser, 2, Dec. 24; Rough-legged

Hawk, 1, Dec. 21; American Coot, 2, Dec. 24; Horned Lark, 3, Dec. 22; Cedar Waxwing, 3, Dec. 23; Northern Shrike, 1, Dec. 24; Starling, 3, Dec. 23; Evening Grosbeak, 4, Dec. 31; White-winged Crossbill, maximum of 6, Dec. 29, 30, and Jan. 1; Lapland Longspur, 6, Jan. 1.

HEPBURN, Dec. 21. On foot about town. 4 species, 9 individuals. Phyllis Siemens.

HUDSON BAY, Dec. 26. 24 miles by car in 2½ hours; temp. 9°; calm; clear. 10 species, 199 individuals. Eldon and Gwen Thorson.

INDIAN HEAD, Dec. 26. 12 miles on foot in 6 hours, 75 miles by car in 3 hours; temp. –8° to +10°; wind S 10 mph; clear; 4 inches of snow. 21 species, 2021 individuals. Carol Beaulieu, Lindy Bray, Tim Glass, Ian Gray, Janet Gray, Richard Gray, Ed Karwandy, Debbie Pike, Brian Scott, Elaine Scott, Marvin Spear, Ronnie Stanger, Bernard Von Tettenborn, (members of the Indian Head 4H Junior Sportsman Club); Jim Craigie and Reg Scott (Club Leaders); Mr. and Mrs. Jim Lang, Lorne Scott (compiler), Gary Seib, Fred Skinner, Mr. and Mrs. Ken Skinner.

KELVINGTON, Dec. 28. Around farm during the day; temp. +10°; clear, sunny; 6 inches of snow. 9 species, 85 individuals. Dianne Sloan. Additional species seen during count period; Sharp-tailed Grouse, 10, Dec. 21; Gray Partridge, 4, Dec. 21; House Sparrow, 32, Dec. 21.

KENASTON, Dec. 26. About the farm; wind light; about 10 inches of snow. 4 species, 15 individuals. Lawrence Beckie. Additional species seen during count period: Sharp-tailed Grouse, 8, Dec. 20; Gray Partridge, 13, Dec. 24; Rock Dove, 5, Dec. 27; Snowy Owl, 1, Dec. 31 and Jan. 1; Horned Lark, 11, Dec. 21; Black-capped Chickadee, 1, Jan. 1; Pine Grosbeak, 1, Dec. 28, Dec. 31; Snow Bunting, 100, Dec. 21.

LEADER, Dec. 31. 2 hours in the field; temp. +32°; 3 inches of snow. 2 species, 27 individuals. Miss Daisy Meyers. Additional species seen during count period: Ring-necked Pheasant, 1, Dec. 25; Hairy Woodpecker, 1, Dec. 26; Pine Grosbeak, 2, Dec. 29.

LIPTON, Dec. 28. 1 mile on foot in ½ hour, 50 miles by car in 3 hours; temp. –5°; calm; clear; 4 inches of snow. 5 species, 827 individuals. Lorne Scott, Perry Seib, Murray Seib, Gary Seib (compiler). Additional species seen during count period: Great Horned Owl, 1, Dec. 31.

MOOSE JAW, Dec. 26. 88 miles by car and 11 miles on foot; temp. –10° to –3°; wind 5 mph; clear; 5 inches of snow. 19 species, 690 individuals. Carl Ellis, John Horton, Pat Kern, Pam Kern, Leith and Cy Knight, H. C. McAvoy, Joyce and Murdoch Nelson, Walter Riome, Molly Ritchie, Ruth and Gordon Silversides, Mrs. Waterson. (Leith Knight, compiler). Additional species seen during count period: Horned Lark, 20; Dec. 28; Bohemian Waxwing, 20, Dec. 30.

NAICAM, Dec. 21. Temp. +10°; snowflurries, changing to intermittent sunshine. 6 species, 43 individuals. Ronald Jensen. Additional species seen during count period: Rock Dove, 26, Dec. 20; House Sparrow, 150, Dec. 22.

NIPAWIN-SQUAW RAPIDS, Dec. 26. All day; temp. –10° to 15°; wind S 10 mph; 19 species, 1168 individuals. Walter Matthews, David and Stan Riome (compilers). Additional species seen during count period: Common Merganser, 4, Jan. 1; Sharp-shinned Hawk, 1, Dec. 29; Black-backed Three-toed Woodpecker, 1, Dec. 27; Boreal Chickadee, 5, Dec. 28; Robin, 1, Dec. 28; Red Crossbill, 1, Dec. 29.

NOKOMIS, Dec. 29. 40 miles by car in 3 hours; temp. 20° to 32°; winds light; overcast. 9 species, 230 individuals. E. R. Clark, J. W. Hamilton. Additional species seen during count period: Bohemian Waxwing, 2, Dec. 30.

OUTLOOK, Dec. 28. 100 miles by car, temp. +10°; sunny; 6 inches of snow. 3 species, 207 individuals. Harold Kvinge. Additional species seen during count period; Snowy Owl, 1, Dec. 22; Horned Lark, 50, Dec. 23.

PIKE LAKE, Dec. 28. 54 miles by car in 7 hours, 1 mile on foot in ½ hour; temp. –3° to +4°; wind S 5 to 8 mph; fog patches and overcast. 16 species, 438 individuals. Dr. and Mrs. J. B. Gollop, Mr. and Mrs. J. A. Wedgewood.

PRINCE ALBERT, Dec. 21. 9 miles on foot in 5 hours, and 265 miles by car in 26 hours; temp. –10° to –6°; wind E 4 to 12 mph; partly cloudy; 3 inches of snow. 20 species, 2839 individuals. Mr. and Mrs. A. O. Aschim, Ron Austin, Mr. and Mrs. W. C. Bliss, Jr., Derek Beacham (compiler), Elizabeth Beacham, Mr. and Mrs. George Lee, Glen Love, Leslie Love, Marion Love, Elsie Morton, Frank Morton, Ray Puddicombe, Mae Sinclair, Mrs. John Small, Eldon Thorson, Julie Willams, Allan Young. Additional species seen during count period: Golden Eagle, 1, Dec. 20; Pigeon Hawk, 1, Dec. 27; Great Horned Owl, 1, Dec. 27; Snowy Owl, 1, Dec. 28; Snow Bunting, 200, Dec. 29.

RADISSON, Dec. 29. 9 miles on foot in 5 hours; temp. +32°; 4 inches of snow. 10 species, 313 individuals. Bryan Rothenburger. Additional species seen during count period: Mallard, 3, Dec. 22; Bald Eagle, 1, Dec. 24; Ruffed Grouse, 2, Dec. 28; Sharp-tailed Grouse, 13, Dec. 26; Snowy Owl, 1, Dec. 20; Hawk Owl, 2, Dec. 20.

RAYMORE, Dec. 31. 10 miles on foot in 5 hours; temp. +15°; wind light from SE; clear. 10 species, 82 individuals. Craig Cameron, Wayne Harris (compiler). Additional species seen during count period: Gray Partridge, 4, Dec. 24; Great Horned Owl, 2, Dec. 20; Downy Woodpecker, 1, Dec. 20; Northern Shrike, 1, Dec. 20.

REGINA, Dec. 26. 244 miles by car and 39 miles on foot in 8¼ hours; temp. –10° to +7°; wind SE 20 to 25 mph; overcast with fog, clearing by noon; 3 inches of snow. 37 species, 4067 individuals. Jessie Bailey, Fred G. Bard, Margaret Belcher, Al Binnie, Betty Binnie (compiler), Greg Bobbitt, Mr. and Mrs. Godfrey Carr, Eric Cooke, Iola Crouse, Betty Cruikshank, Denise Dawson, Elmer Fox, Billy Gilmore, Doug Gilroy, Jim Hines, Gail Hipperson, Harriet Jowsey, Jim Jowsey, Shirley Jowsey, Larry Kerwin, Shirley Larmour, George Ledingham, Christine McDonald, G. J. Mitchell, Helen Morrison, Mr. and Mrs. Anatol Murad, Connie Pratt, Maureen Rever, J. K. Roberts, Bill Roff, E. Toupich, Elisabeth Wagner, Janie Wilhelm. Additional species seen during count period: Prairie Falcon, Dec. 27, 28; Ring-billed Gull, Dec. 23; Northern Shrike, Dec. 24.

SASKATOON, Dec. 26. 31 miles on foot in 34 hours, 240 miles by car in 36½ hours; temp. –6° to +7°; overcast; calm; 6 inches of snow. 30 species, 8662 individuals. Mark Abley, Michael and Rod Bantjes, Bob, Joan and Jeff Besant, John Beveridge, Tom Beveridge, Ed Bisha, Raymond Bisha, Hans Blokpoel, Herman Boerma, Pern Cordrey, David Epp, Kim Epp, Glen A. Fox, Betty Gerrard, Jonathan Gerrard, Peter Gerrard, Marie Gillespie, Dr. and Mrs. J. B. Gollop, Stuart Golly, Annie Guenther, Scott Hale, Dr. C. J. Houston, Dr. and Mrs. Stuart Houston, David Houston, Donald Houston, Margaret Houston, Jeff Krolik, Anna Miller, Mr. and Mrs. George McVittie, Grant and James McVittie, Arnold Nijssen, David Nowosad, Molly O'Neill, Bohdan Pylypec, David Russel, John Shadick, Stan Shadick, Jim Slimmon, Alan R. Smith, Fred Waite, Jim Wedgewood, Shirley Wedgewood. Additional species seen during count period: Robin, 1, Dec. 27, 28; Flicker, 1, Dec. 23, 29.

SKULL CREEK, Dec. 26. Area covered on foot, horseback and car; temp. +20°; wind brisk; 3 inches of snow. 16 species, 1624 individuals. Jim, Ray and Lena Bennetto, Henry Borman, Austin Drever, Johnny Drever, Bob Ecclestone, Phyllis Flaig, Eileen Knight, Jim and Bill Knight, Betty and Patti Mann, Ray and Helen Schuler, Peter Swain.

SPIRIT LAKE, Dec. 28. 4 miles in 1½ hours on foot and 35 miles in 2½ hours by car; temp. –6° to +10°; wind

CHRISTMAS BIRD COUNTS, 1969

	ABERDEEN SMUTS	BANGOR	BROADVIEW	CRAVEN	CUMBERLAND HOUSE	DILKE	ERINFERRY	FORT QU'APPELLE	HEPBURN	HUDSON BAY	INDIAN HEAD	KELVINGTON	KENASTON
WESTERN GREBE													
WHITE PELICAN													
MUTE SWAN													
WHISTLING SWAN													
CANADA GOOSE								13					
MALLARD						6		100			400		
PINTAIL													
REDHEAD													
CANVASBACK													
LESSER SCAUP								1			1		
COMMON GOLDENEYE								4					
BUFFLEHEAD													
RUDDY													
COMMON MERGANSER													
RED-BREASTED MERGANSER													
GOLDEN EAGLE													
BALD EAGLE													
PIGEON HAWK													
RUFFED GROUSE		1			2						3	1	
SHARP-TAILED GROUSE								3		12	14		
SAGE GROUSE													
GRAY PARTRIDGE	14					12			5		3		
RING-NECKED PHEASANT			2										
COOT													
ROCK DOVE	16		4	9		18		7		10	28		
GREAT HORNED OWL		1		1	2						1		
SNOWY OWL	1										1		
SHORT-EARED OWL						1							
YELLOW-SHAFTED FLICKER													
PILEATED WOODOPECKER										1			
HAIRY WOODPECKER		1			8		2	1			9		
DOWNY WOODPECKER					5		2	3			8	2	
N. THREE-TOED WOODPECKER					1								
HORNED LARK	3					31					23		
GRAY JAY					2		2	1	1	1	1		
BLUE JAY							2	2			4	4	
BLACK-BILLED MAGPIE	33	11	15	26	4	26	3	10		4	24	4	
COMMON RAVEN					12					29			
COMMON CROW													
BLACK-CAPPED CHICKADEE		3	4		18		6	13	1		27	6	
RED-BREASTED NUTHATCH													
ROBIN													
BOHEMIAN WAXWING								8			55		
NORTHERN SHRIKE				1									
STARLING			3				13						
HOUSE SPARROW	53	25	25	278	17	140	6	8	2	12	274		
RUSTY BLACKBIRD						4							
BREWER'S BLACKBIRD								1					
EVENING GROSBEAK			2		21					18	2	48	
PINE GROSBEAK			100	13	19			26		8	58	3	
PURPLE FINCH													
HOARY REDPOLL					62			3					
COMMON REDPOLL	605	463	200	116	35	1660		47		104	530	14	
RED CROSSBILL													
WHITE-WINGED CROSSBILL													
SLATE-COLORED JUNCO													
TREE SPARROW													
LAPLAND LONGSPUR													
SNOW BUNTING	6	20					100	25			555	3	
INDIVIDUALS	731	525	355	444	208	1898	136	276	9	199	2021	85	
SPECIES	8	8	9	7	14	9	9	19	4	10	21	9	
OBSERVERS	2	1	2	2	7	6	1	19	1	2	22	1	

LEADER	LIPTON	MOOSE JAW	NAICAM	NIPAWIN-SQUAW RAPIDS	NOKOMIS	OUTLOOK	PIKE LAKE	PRINCE ALBERT	RADISSON	RAYMORE	REGINA	SASKATOON	SKULL CREEK	SPIRIT LAKE	VALLEY-CENTRE-MARRIOTT	VAL MARIE	WHITE BEAR	WOLSELEY	YORKTON
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	7 63	354	.....	91	4	.....	10	705	100	25	1367	4028	20	52	326	26	75	.....	181
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3 ...	.....	3	.....	7	.....	.....	128	124	.....	7	92	422	.....	1	.....	.....	.....	.....	17
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14 ...	540	205	.....	600	50	.....	213	1549	45	3	174	1598	226	253	1	137	20	14	342
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8 ...	200	3	2	297	130	200	4	.....	72	16	21	664	1160	.....	20	1312	35	.....	242
85	27 827	690	43	1168	230	207	438	2839	313	82	4067	8662	1624	405	409	1592	175	242	1072
9	2 5	19	6	19	9	3	16	20	10	10	37	30	16	14	9	12	8	5	14
1	1 4	15	1	3	2	1	4	20	1	2	35	49	16	4	2	2	1	8	9

almost calm; overcast with light snow until 11 a.m. then sunny; 6 inches of snow. 14 species, 405 individuals. Wm. Anaka, Mrs. Gunn, Joyce Gunn, Frank Switzer. Additional species seen during count period: Goshawk, 1, Dec. 20; Pileated Woodpecker, 1, Dec. 20, 26, 30, Jan. 1; Snow Bunting, 8, Dec. 25 and 26 and 300, Dec. 31.

VALLEY CENTRE-MARRIOTT, Dec. 23. 13 miles by car and 5 miles on foot in 2¼ hours; temp. +5° to +20°; blizzard conditions in a.m., sunny with light wind in p.m.; 12 inches of snow. 9 species, 409 individuals. Wayne and Don Renaud. Additional species seen during count period: Rock Dove, 4, Dec. 30; White-breasted Nuthatch, 1, Dec. 27; Northern Shrike, 1, Dec. 24.

VAL MARIE, Jan. 1. 50 miles by vehicle, 3 miles on foot. Temp. +20°; wind light; 2 inches of snow. 12 species, 1592 individuals. Gordon and David Chandler. Additional species seen during count period: Mallard, 7, Dec. 20; Rough-legged Hawk, 1, Dec. 20; Gray Partridge, 7, Dec. 27; Rock Dove, 13, Dec. 20; Short-eared Owl, 1, Dec. 20; Pine Grosbeak, 3, Dec. 21.

WHITE BEAR, Dec. 26. 37 miles; temp. +10°; wind calm. 8 species, 175 individuals. S. O. Jordheim. Additional species seen during count period: Prairie Falcon, 1, Dec. 28; Starling, 5, Dec. 28.

WOLSELEY, Dec. 30. 50 miles by car and 2 hours on foot; temp. +20°; wind light; 6 inches of snow. 5 species, 242 individuals. Collin Crawford, Donald Hayward (compiler), Bernard Schneider, David Schneider, Frank Schneider, Kelly Scott, Michael Stroh, Lawrence White. Additional species seen during count period: Ruffed Grouse, 1, Dec. 28; Sharp-tailed Grouse, 3, Dec. 24; Great Horned Owl, 1, Dec. 26; Hairy Woodpecker, 1, Dec. 27; Pine Grosbeak, 2, Dec. 23.

YORKTON, Dec. 26. 108 miles by car and 16 miles on foot in 17 hours; temp. –11° to –4°; wind SSE 5 mph; 4 inches of snow. 14 species, 1072 individuals. Wm. Anaka, Richard Burback, Larry Morgotch, Frank Switzer (compiler), members of the Senior Natural History Society, and Glen Burback, Dale Esopanko, Keith Monette, Doug Monette, Brian Procyshen, members of the Junior Natural History Society.

FORT SMITH, N.W.T., Jan. 1. 65 miles by car in 3½ hours; temp. 10°; wind light; intermittent light snow; 8 to 10 inches of snow. 6 species, 135 individuals. Spruce Grouse, 2; Rock Dove, 9; Gray Jay, 2; Common Raven, 51; House Sparrow, 14; Common Redpoll, 57. Add: Pine Grosbeak, 6, Dec. 24 and 14, Dec. 31. Ernie, Elsie and Pamela Kuyt.

EDMONTON, Alta., Dec. 21. 51 miles on foot in 37 hours and 271 miles by car in 26 hours; temp. +14° to +24°; wind E 9 to 15 mph; cloudy in a.m., snowing to 3 p.m., 2½ inches of snow. 31 species, 5969 individuals. Mallard, 174; Common Goldeneye, 70; Goshawk, 1; Pigeon Hawk, 7; Ruffed Grouse, 6; Sharp-tailed Grouse, 10; Ring-necked Pheasant, 13; Gray Partrdige, 173; Rock Dove, 207; Great Horned Owl, 1; Snowy Owl, 2; Short-eared Owl, 18; Pileated Woodpecker, 1; Hairy Woodpecker, 3; Downy Woodpecker, 6; Blue Jay, 41; Black-billed Magpie, 196; Black-capped Chickadee, 139; Boreal Chickadee, 5; White-breasted Nuthatch, 4; Bohemian Waxwing, 2480; Northern Shrike, 1; Starling, 6; House Sparrow, 1941; Rusty Blackbird, 1; Evening Grosbeak, 98; Pine Grosbeak, 51; Common Redpoll, 32; Red Crossbill, 51; White-winged Crossbill, 81; Snow Bunting, 150; T. Balacko, K. Ball, T. Barry, S. Beacom, H. Campbell, V. Claerhout, P. Demulder, G. Evans, L. Fenna, J. Gulley, D. Gulley, R. Heath, M. Hennie, O. Höhn, H. Horton, B. Horton, E. Jones, R. Lister, A. MacGregor, D. Robinson, A. Rupp, F. Rusconi, D. Spalding, P. Taylor, P. Thompson, R. Turner (compiler).

If you want to help with the Breeding Bird Survey, write to Frank Brazier, Box 1121, Regina.

THE BREEDING BIRD SURVEY IN CANADA

by **A. J. Erskine,** Canadian Wildlife Service, Ottawa

The Breeding Bird Survey is a co-operative attempt by volunteer and professional bird students to detect and measure year-to-year changes in numbers of birds across North America. Man's activities are changing his environment at an ever increasing rate, in ways which may be expected to affect bird numbers. In recent years, pollution (including biocides) has become so massive and widespread that people are concerned whether any living creatures, man included, can long survive. The Breeding Bird Survey is one of several ways in which we hope to be able to monitor changes in bird populations resulting from environmental changes. Other methods used elsewhere, such as nesting studies and censuses of sample plots, require that observers restrict their activities to relatively small areas, in marked contrast to the wide-ranging habits of most North American bird watchers. The Breeding Bird Survey was planned with car travel and large areas in mind, and accordingly has received enthusiastic support from volunteer assistants.

The procedure used was developed in Maryland by Chandler S. Robbins of the United States Fish and Wildlife Service. It was first used in Canada in 1966, and was used in all provinces except Newfoundland in 1968 and 1969 (Table 1). Operations in Canada are under general supervision by the Canadian Wildlife Service. Each survey is based on a randomly selected starting point and direction, and each comprises 50 stops, of 3 minutes each, at one-half mile intervals along a road. Each route is surveyed once, under favourable conditions, during June, starting one-half hour before sunrise. At each stop, all birds heard and all seen within ¼ mile are listed on forms, as are data on temperature, wind, clouds or precipitation, sky, and starting and finishing times.

Year-to-year changes are compared for routes with similar coverage, that is, those with the same observer in successive years, on comparable dates, in similar weather, and adhering to the prescribed procedures. This system of rating comparability of coverage is more restrictive than that used in the United States; we are dealing with much smaller numbers of surveys, among which those that are not

Table 1. Numbers of Breeding Bird Survey routes covered in each province, 1966-1969. Duplicate coverages and non-random routes are excluded. No surveys have been made in Newfoundland in any year.

Province	Number of routes surveyed 1966	1967	1968	1969
Prince Edward Island	2	4	4	4
Nova Scotia	16	20	20	20
New Brunswick	15	19	22	23
Quebec	3	7	17	20
Ontario	0	4+†	41	40
Manitoba	—	11	12‡	12
Saskatchewan	—	—	3	6
Alberta	—	—	5	7
British Columbia	—	—	16	16

† Results for a number of Ontario routes surveyed in 1967 were lost by the person then acting as provincial co-ordinator; the number of routes actually covered in that year is unknown.

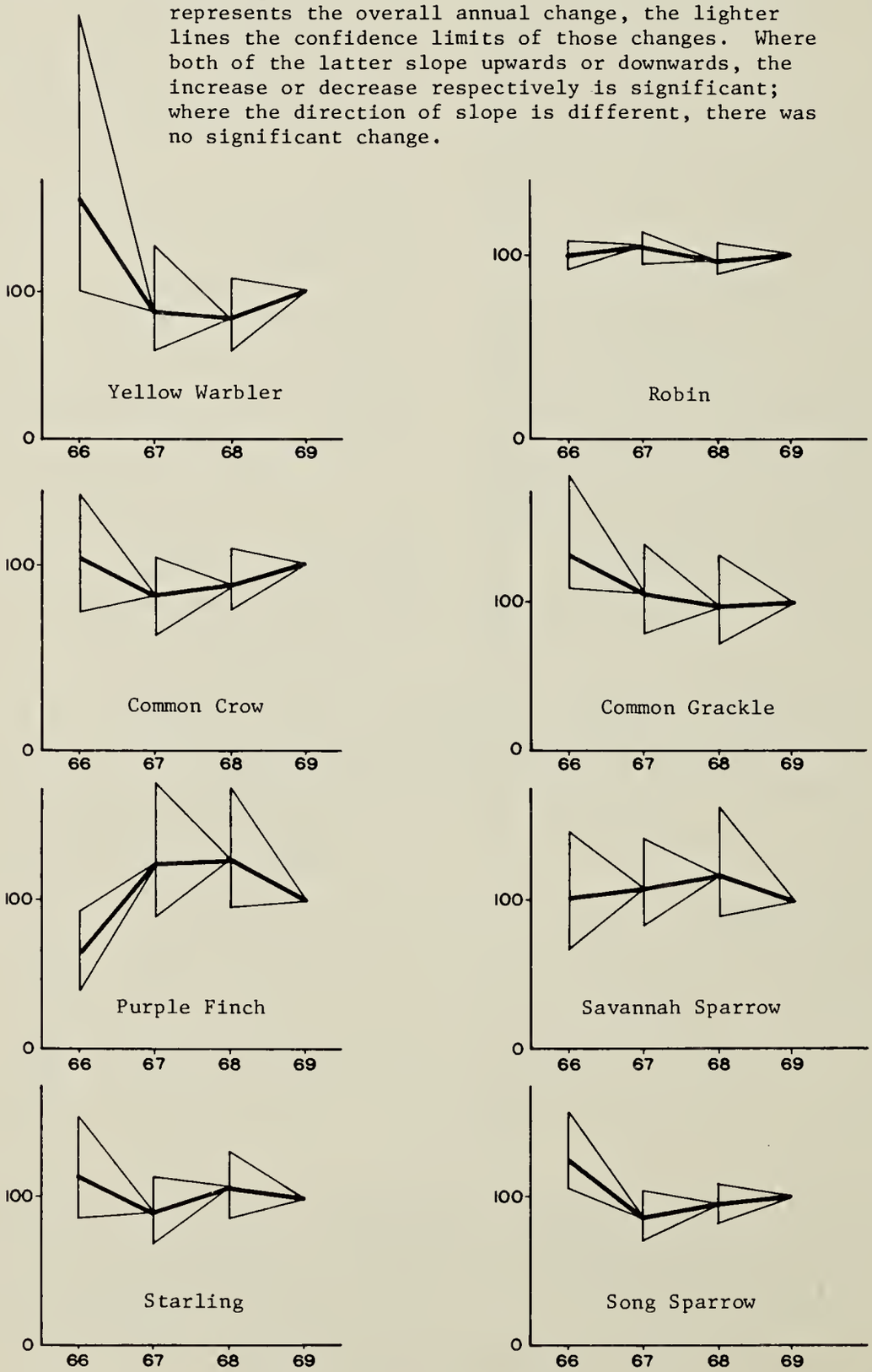
‡ Includes one survey done from an outboard canoe, with 25 stops each on two successive mornings, around the perimeter of a large lake.

fully comparable between years are more apt to distort the results. Analyses have been made only for reasonably uniform areas within which 15 or more (preferably 25 or more) routes received comparable coverage in successive years.

Birds Census in Britain (S. M. Taylor, 1965, *Bird Study*, 12:268-285), and is outlined in a more detailed publication on the Breeding Bird Survey now in preparation.

The trends shown in Figure 1 suggest that the Survey will adequately detect and describe changes resulting from severe weather during future migration or breeding seasons. It should also detect changes in land use; most changes of this type will affect only a few stops on any given

Figure 1 Population indices for eight major species, 1966-69, Breeding Bird Survey, Maritimes. The central line represents the overall annual change, the lighter lines the confidence limits of those changes. Where both of the latter slope upwards or downwards, the increase or decrease respectively is significant; where the direction of slope is different, there was no significant change.



route in any one year, so the Survey will need to continue for many years before such effects are demonstrable on a province-wide scale. It remains to be seen whether the effects on birds of pollution and pesticides can be demonstrated by this procedure. As data become available, we hope to develop more sophisticated analysis methods to measure the significance of the minor but sustained changes that we tend to associate with these influences; our present methods are probably adequate to document any relatively major changes between years.

Some people will object that this is a lot of work to put into a relatively unproven method, and it certainly is. Yet we do not have the next ten years in which to work out and test this and other methods; by 1980 the effects of man-caused pollution will, if not checked, be upon us, and we will need all the data we can to show what conditions prevailed in earlier times. It is obviously unfortunate that this method was not in use earlier; most of us have impressions that certain species have decreased or increased over a period of years, but we have no satisfactory numerical data to support these beliefs. The Breeding Bird Survey is one way in which we can systematically collect data on bird numbers, and we can use more assistance than we now have.

We have not yet been able to set up analyses for routes in the Prairie Provinces. Of the 20 routes surveyed in 1968, 16 were covered again in 1969, but only 8 received comparable coverage, according to the criteria used elsewhere. We are especially anxious to increase the coverage in the prairie areas of Saskatchewan and Alberta in 1970; these areas have received far more treatment with pesticides than have the parkland and forested areas to the north, and are thus in more need of an effective monitoring system. There are about 70 degree-blocks of prairie (grassland, grain, and fallow) in the three provinces; we need about 40 routes surveyed in order to ensure that 25 receive comparable coverage from year to year.

It is not essential to be able to identify all sounds made by our native birds in order to take part in these surveys (it does help!) The important thing is to be able to correctly identify the common species, as analyses will usually be restricted to these birds. If we have to choose, we find it more helpful to have someone of average competence who can provide coverage for a number of successive years, rather than the local expert who will be birding in South America next year and in Europe two years after that. Consistent coverage is critical.

CO-OPERATIVE SPRING MIGRATION STUDY

Records are again requested for the continent-wide survey being made under the auspices of the U.S. Fish and Wildlife Service. For a list of species studied, see *Blue Jay*, September 1968, Vol. 26, #3, pp. 132-3. All records should be submitted by June 15, 1970 to:

Mrs. Mary Houston,
863 University Drive,
Saskatoon, Sask.

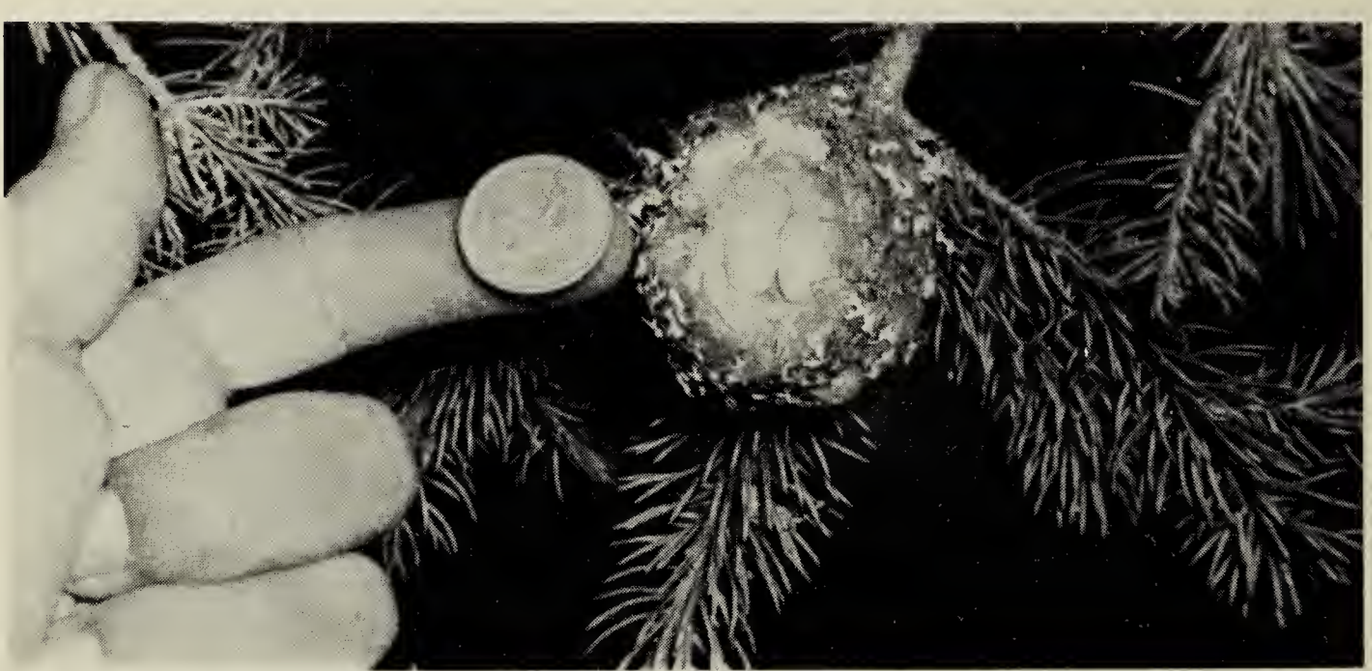
PRAIRIE NEST RECORDS SCHEME

Contributors are reminded to send 1970 nest records cards to Dr. Robert W. Nero, Prairie Nest Records Scheme, Manitoba Museum of Man and Nature, Winnipeg 2. If you have not previously contributed to the scheme but are interested in keeping records, write to Dr. Nero for information and nest record cards. Also available from him is the summary of the scheme's first 10 years operation (1958-67).

RUFOUS HUMMINGBIRD AT JASPER, ALBERTA

Photographs by **R. E. Gehlert,** 1701 20th Street W., Saskatoon

Rufous Hummingbird in Jasper National Park, Alberta



Rufous Hummingbird eggs compared with twenty-five cent piece

Rufous Hummingbird female showing metallic quality of the green back feathers

Photos by R. E. Gehlert

Close-up of incubating female Rufous Hummingbird

FACTORS INFLUENCING THE STATUS OF EASTERN AND MOUNTAIN BLUEBIRDS IN SOUTHWESTERN MANITOBA

by **Wayne Miller,** 2 Almond Crescent, Brandon, Manitoba

Several authors have intimated that the Mountain Bluebird *(Sialia currocoides)* successfully competes with the Eastern Bluebird *(Sialis sialis)* in areas of range overlap. For example, Lawrence (1947) has suggested that gains in territory for Mountain Bluebirds are "generally made at the expense of the russet-breasted Eastern Bluebird."

The history of the occurrence of bluebirds in Manitoba offers opposing arguments with regard to the above possibility. Criddle (1904) found Mountain Bluebirds "by no means uncommon" in the Spruce Woods Forest Reserve in the 1890's. At the same time, however, the Eastern Bluebird was expanding its range to include such areas as Portage la Prairie and Carberry (the latter on the northern edge of the Spruce Woods!) (Thompson, 1891). In fact, Thompson (1893) later states: "this species, [*sialis*] instead of [being] very rare, has become quite common in the country along the Assiniboine . . . " Certainly, the fact that Eastern Bluebirds could expand their range to include areas of Mountain Bluebird occupation and at the same time increase their numbers does not support the hypothesis.

On the other hand, Criddle (1927: 40) later commented on the interactions between *sialis* and *currocoides* in a manner which suggests that territorial interactions between bluebird species affected their relative populations: "One pair of Mountain Bluebirds came to us about the year 1912 when they successfully fought for possession of a box with a pair of Eastern Bluebirds. The two continued as neighbours . . . but as the western birds increased the eastern ones diminished in numbers, until in 1925 our boxes were occupied by Mountain Bluebirds alone."

The existence of apparently conflicting data such as the above points out a need for investigation into the influence of interspecific interaction on the status of Eastern and Mountain bluebirds in an area of range overlap.

Study Area and Study Resources

This present study of bluebird interactions was conducted in southwestern Manitoba, generally about Brandon. Several factors make this area somewhat unique for such a study in comparison to the rest of Canada.

Although the breeding ranges of Mountain and Eastern bluebirds overlap in southwestern Manitoba and southern Saskatchewan (see Godfrey, 1966), the breeding populations of Eastern Bluebirds in Saskatchewan are not sufficient to produce large-scale interaction with Mountain Bluebirds (see Belcher, 1966). East of Brandon as the eastern fringe to the Mountain Bluebird's range is approached, Mountain Bluebird numbers diminish appreciably. Therefore, the relatively small area between Carberry and Virden appears to be the only point in Canada where interactions between these two bluebirds can be observed on a large scale. In addition, both *sialis* and *currocoides* have increased their numbers near Brandon in recent years.

In 1959, Mr. John Lane and a group of boys began what developed into a 1700-box nest line by 1968 in southwestern Manitoba. Figure 1 shows the extent of this nest line. Between 1966 and 1968 I recorded observations of bluebird behaviour on this nest line.

In 1969, I studied the reproductive success and territorial interactions of *sialis* and *currocoides* in an area near Camp Hughes. Camp Hughes (Fig. 1 "A"), located on the northern edge of the Spruce Woods Forest Reserve, comprises a mixture of *Stipa-Andropogon* Sand Prairie, Aspen Poplar Forest, and White Spruce Sand

Hill Community (after Bird, 1961). This area holds a high concentration of bluebirds in comparison to the rest of the nest line, largely because this combination of habitats, which appears to be desirable to both bluebird species, seldom occurs elsewhere in southwestern Manitoba. Judging from observations on the nest line, bluebirds prefer sandy areas of short grass prairie with moderate amounts of aspen cover.

Near Camp Hughes, nest boxes were erected on fences along roadways and a railway. In most cases, utility lines ran above or near the nest sites, providing over-head perches. This area was visited once weekly during the nesting season.

Present Bluebird Populations

The results in Table 1 (compiled from the Annual Reports of the Brandon Junior Birders' Club and from the original data for the nest line) indicate present trends in relative bluebird populations about Brandon. Over the six-year period included in this table, bluebirds of both species became more common, initially using 6.7 per cent of available nest sites, and ultimately 21.3 per cent. Due to the specialized nesting requirements of both *sialis* and *currocoides* (discussed under "Nest Requirements . . . ") I suspect that comparative figures for more natural conditions would be considerably lower, but nonetheless proportional. Although Eastern Bluebirds increased fairly steadily up to 1966, Mountain Bluebirds became more dominant in "per cent of bluebird total that were *currocoides*" *(currocoides)* 56.0 per cent for 1963, 80.1 per cent for 1968). This suggests that acceleration of the population growth for *sialis* was impeded for various reasons. The greater success of *currocoides* is further demonstrated by the rise from 3.7 per cent to 17.3 per cent for the "per cent of total boxes checked that were *currocoides*," when compared to *sialis* which reached a maximum of 5.9 per cent (1966). After 1966, *sialis* populations declined (see Fig. 2).

The following discussion will consider whether the decline of Eastern

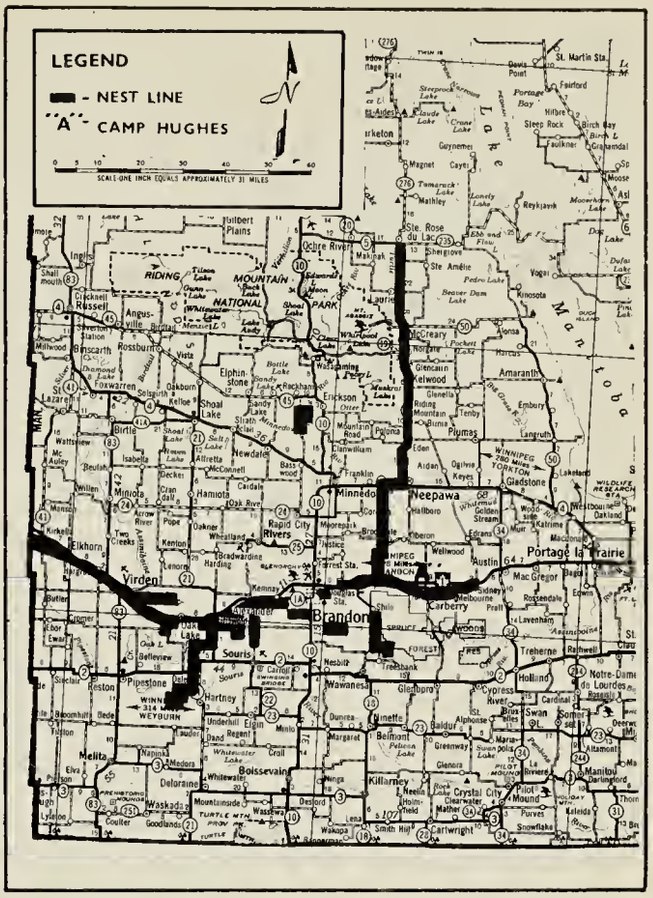


Fig. 1. Map of southwestern Manitoba showing the extent of the nest line in 1968 and the Camp Hughes study area.

Bluebirds is solely accounted for by interactions with Mountain Bluebirds, or whether other factors contributed.

1) Nest requirements and availability of nest sites

Throughout the nest line it was found that bluebird populations were highest in areas where aspen woodland intersected sand prairie (for example, Oak Lake, Camp Hughes, Melbourne, Grand Clarier). Eastern Bluebirds favoured the use of woodland retreats and consequently their nests were generally located nearer woodlands than those of Mountain Bluebirds. This trend was evident at Camp Hughes in 1969.

Both bluebird species preferred a deep nest cavity, although Mountain Bluebirds were observed to nest in shallow boxes on numerous occasions, whereas Easterns used these rarely. The presence of tall weedy growth at the base of the nest site discouraged bluebird nestings. Mountain Bluebirds occupied boxes which did not afford a nearby perch more often than did Eastern Bluebirds. Two such nestings were recorded for Mountain

TABLE 1 Trends in relative bluebird populations on the nest line, 1963-1968

	1963	1964	1965	1966	1967	1968
Number of boxes checked	749	740	774	801	1200*	1400†
Number of total checked that were bluebirds (a)	50	79	106	126	215	302
Per cent of total checked that were bluebirds	6.7	10.7	13.7	15.8	17.9	21.3
Number of total checked that were *currocoides*	28	50	66	79	160	242
Number of total checked that were *sialis*	22	29	40	47	55	60
Per cent of bluebird total that were *currocoides* (b)	56.0	63.3	61.9	62.7	74.4	80.1
Per cent of bluebird total that were *sialis*	44.0	36.7	38.1	37.3	25.6	19.9
Per cent of total boxes checked that were *currocoides*	3.7	6.8	8.5	9.9	13.3	17.3
Per cent of total boxes checked that were *sialis*	2.9	3.9	5.0	5.9	4.6	4.3

(a) = first brood nestings only
(b) = figured on first brood nestings only
* = approximate, due to Tree Swallow estimation
† = although the Annual Report for 1968 gives about 1500 nest results, this figure includes an approximation of Tree Swallows.

Bluebirds in the Camp Hughes area in 1969.

The above factors suggest that *sialis* is more selective than *currocoides* in terms of nesting requirements. It is therefore reasonable to presume that the species would suffer in the light of increasing nest competition (see "Nest competition . . . "), since their specialized requirements are not usually met.

In addition to the above problem, bluebirds face a scarcity of natural nest sites in southwestern Manitoba. Near Camp Hughes, for example, natural sites are few because aspens rarely grow large enough to provide them. Formerly, this was not a serious problem, since telephone poles and fence posts often held cavities (Lane, pers. comm., 1969; also see Bird, 1961:94). At present, however, the frequent replacement of decaying telephone and fence posts eliminates this vital source of nest sites.

2) Nest competition and predation

Nest competition caused *sialis* much difficulty in securing a nest site. Major competition was with Mountain Bluebirds and Tree Swallows *(Iridoprocne bicolor)*. It is significant that neither bluebird species would nest in a box holding an old clutch of eggs of another species. Mountain Bluebirds were less affected by Tree Swallow competition for reasons discussed under "Spring migration . . . "

Bluebirds of both species competed with House Wrens *(Troglodytes aedon)* which victimized nests near woodlands. On several occasions, I have observed abandoned nests of bluebirds which contained clutches of punctured eggs, and I suspect wrens were responsible.

House Sparrows *(Passer domesticus)* and Deer Mice *(Peromyscus maniculatus)* were also a problem for both bluebird species. Leslie North (pers. corr., 1969) reports an unusual case of Deer Mouse competition at Pratt, where mice drove a pair of Mountain Bluebirds from a box, and built under the bluebird nest. Normally, Deer Mice simply appropriate unused boxes. Swenson (1968) has raised the possibility that Deer Mice may be serious competitors for Mountain Bluebirds in some areas of Montana. It is interesting to note that

in southwestern Manitoba, boxes appropriated by Deer Mice were almost always erected on rough fence posts, enabling the rodents to climb them. Because bluebirds naturally nest at higher elevations than those of boxes on the nest line (Godfrey, 1966, gives a range of 3 to 30 feet for *sialis*), it is questionable whether mice are significant nest competitors for bluebirds nesting in natural cavities in this region.

Starlings *(Sturnus vulgaris)* have become more of a threat in recent years. At least two pairs occupied boxes on the nest line in 1968, and in 1969 there were more cases (see Randall and Lane, 1969). In 1969 at Camp Hughes a pair of Starlings drove out a pair of nesting Mountain Bluebirds. Leslie North referred to Starling competition at Pratt, and Mrs. N. Brooks (pers. corr., 1969) reports that on her farm near Hamiota, "every old woodpecker hole" is occupied by Starlings.

One instance of predation upon Eastern Bluebirds by an Eastern Chipmunk *(Tamias striatus)* was noted near Carberry (Miller, 1968).

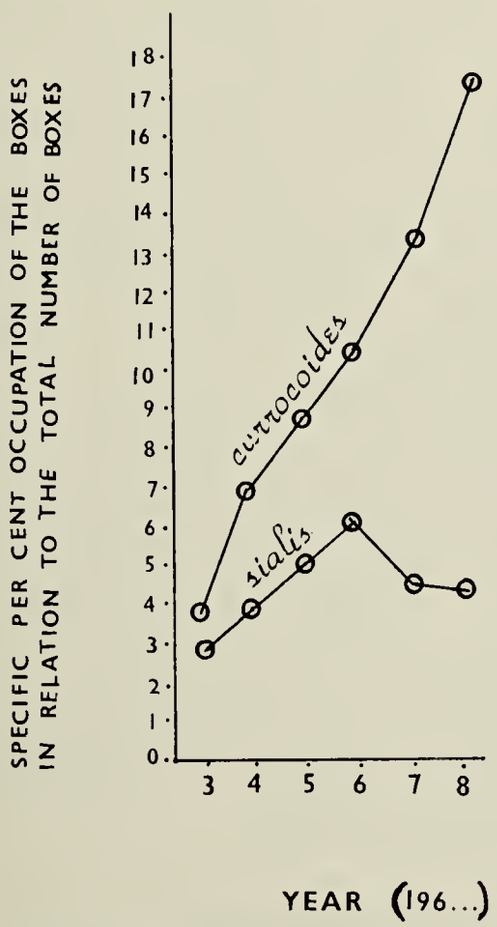


Fig. 2. Population growths of Mountain and Eastern bluebirds on the nest line, 1963-1968.

Because of such competition, it may be that many pairs of Eastern Bluebirds go without nesting for entire seasons. In 1967, for example, several pairs began nesting as late as June 29 near Camp Hughes apparently because cavities could not be obtained sooner. (Boxes were recently erected in the area. The possibility that these birds were second-brood nesters is unlikely since most Eastern Bluebirds in the area were engaged in first brood nestings, and since Eastern and Mountain bluebirds generally renest in the box used for the first brood or in a neighboring box.) The aforesaid nests were later abandoned for unknown reasons. The belief that Eastern Bluebirds were desperate for nest sites is supported by the following observation: On June 11, 1968, just east of Camp Hughes, Mr. John Lane and I watched an Eastern Bluebird pair enter box No. 85 less than five minutes after its erection, after some conflict with an interested Mountain Bluebird male, which may have commanded a nearby territory.

3) Spring migration and spring weather conditions

Early spring arrival for Mountain Bluebirds gives the species a decided advantage over Tree Swallows and Eastern Bluebirds in securing a territory and nest site. The mean first arrival dates for Brandon, 1963-1969, for these three species are:

Mountain Bluebird .....March 27
Eastern Bluebird.....April 19
Tree Swallow.....April 27

Although the first Eastern Bluebirds appear before Tree Swallows, the majority arrive after both Mountain Bluebirds and Tree Swallows have begun nesting. Whereas *currocoides* migration is generally complete by late April, *sialis* is often still arriving in early June. This migration behaviour accounts, in part, for the difficulty *sialis* has in securing a nest site (see "Nest requirements . . . "). If the percentage of Eastern Bluebirds which attain to reproduction is lower than with Mountain Bluebirds, as suggested by the apparent surplus of Easterns at Camp Hughes in 1967 and 1968, then late

spring arrival along with the saturation of breeding territories by Mountain Bluebirds and Tree Swallows offers an explanation for this phenomenon.

Eastern Bluebirds compensate for late migration by arriving already paired, making it possible to undertake a nesting upon or soon after arrival. This behaviour varies with *currocoides*: Criddle (1927:40) reported that male Mountain Bluebirds preceded females by several days at Treesbank, Manitoba. On the other hand, I noted birds in pairs upon their arrival at Griswold in 1968.

Early spring migration subjects Mountain Bluebirds to hazardous weather conditions which the later arriving Easterns do not experience. In 1965 and 1968, for example, snow storms destroyed entire first clutches of Mountain Bluebirds throughout the nest line. Leslie North (pers. corr., 1969) writes that in one such storm, "more than one bluebird was found dead in the boxes." This is significant since North maintains only about 20 boxes near Pratt, Manitoba. The number of Mountain Bluebirds affected by these storms depends upon the date of the storm and its severity. Severe storms cause a noticeable delay in the nesting activities not only through adult mortality, but by frightening the females off the nests long enough for the eggs to chill. Earlier storms have less effect, since the number of bluebirds engaged in nesting is small, and since nesting is not advanced sufficiently to suffer drastic set-backs.

It might be argued that because southwestern Manitoba is on the western edge of the Eastern Bluebird's range in Canada, few pairs are attracted to nesting areas. Again, in view of the apparent surplus of Easterns in areas such as Camp Hughes (see "Nest competition . . . "), this is probably not a dominant factor in regulating the populations of bluebirds in southwestern Manitoba although this hypothesis may certainly apply to some areas of Saskatchewan.

4) Nest care and aggression

Nest care and defence of the nest is considerably stronger for *currocoides*. On numerous occasions, male Mountain Bluebirds launched into vigorous attacks when I visited the nests, the severity of which was in direct proportion to the stage of nest development. (For a description of the defence mechanisms of Mountain Bluebirds, see Power, 1966). Contrastingly, I rarely saw male Eastern Bluebirds put forth aggressive defence under these circumstances. Perhaps human intrusion is not regarded as a serious threat to the nest, since *sialis* can show remarkable concern for the young (see Miller, 1968).

Female Mountain Bluebirds also displayed more concern for the nest and young than Eastern females. Usually Mountain females would assist the males in defending the nest against intrusion, whereas this was very unusual for Eastern Bluebird females. Many times in checking the nest boxes it was necessary to lift *currocoides* females from the nests to count eggs or young. Only once during my studies at Camp Hughes in 1969 did an Eastern female sit so tightly.

In 1967 and 1968, several unmated male Eastern Bluebirds commanded inactive nest sites. The fact that these birds could retain such nests for entire seasons in spite of competition is significant. Perhaps the presumed shortage of nest sites for *sialis* is not great, suggesting that other factors besides a limitation of nest sites contributed to the decline of *sialis* in 1967 and 1968.

In contrast to the above, I have not seen solitary male Mountain Bluebirds defending inactive nest sites, although males will care for the young should the female be killed. Leslie North, of Pratt, reports one such instance for 1968 (pers. cor., 1969).

Mr. John Lane observed a solitary female Mountain Bluebird caring for an active nest near Camp Hughes in 1968 and recalls cases of similar behaviour for Eastern Bluebird females for the same year.

Mountain Bluebirds are generally more aggressive than Easterns, and are capable of evicting already nesting pairs of Eastern Bluebirds. On

June 6, 1969, I saw a Mountain Bluebird male engaged in conflict with a male Eastern at box No. 858 at Camp Hughes. Prior to that date the box had been occupied by Easterns, so presumably this was the Eastern male defending his own territory. A female sat nearby while the two males struggled and clawed on the ground. The Mountain Bluebird was definitely the aggressor, and used the tactic of "flying in pursuit" many times (after Power, 1966). When the box was visited on a later date, Mountain Bluebirds had built a nest and had laid five eggs. There was no sign of the Easterns. Although instances such as the above do not provide sufficient evidence to conclude that *currocoides* regulates *sialis* numbers on the nest line, they do suggest the possibility.

It is interesting to compare the above with observations made on a nest line harbouring Eastern Bluebirds only. Herb Copland (pers. corr., 1969) writes that on a nest line consisting of 22 operative boxes near Vivian, Manitoba, none of which are occupied by Mountain Bluebirds, the nest care of Eastern Bluebirds is quite strong in many instances. He reports cases of having to lift a female Eastern from the box to count the young, of being mobbed by adult Easterns when at the box, and of "agitated" adults. He comments, "It would also seem that the female Eastern Bluebirds refuse to leave the nestbox . . . because the eggs are either heavily incubated and near the point of hatching or they are brooding newly hatched young." Indeed, such statements might well apply to Mountain Bluebirds in southwestern Manitoba on the nest line. This leads one to suspect that the degree of nest care and aggression varies in Eastern Bluebirds from one area to another. It may be that in areas of range overlap such as southwestern Manitoba, the presence of *currocoides* represses these qualities, although the mechanisms of this repression are not clear.

5) Nest success and second brood nestings

During the nesting season of 1969, I sampled the Camp Hughes study area to compare the nesting successes of Mountain and Eastern bluebirds. Only first brood nestings were considered in this facet of the study. The results are outlined in Table 2.

The unusually high incidence of vandalism at Camp Hughes may have caused the nesting success for *currocoides* to be slightly low in comparison to other areas on the nest line. It is interesting to note that no nest failures for Eastern Bluebirds are attributable to vandalism. This reflects the tendency of Eastern Bluebirds to choose more secluded nest sites than Mountain Bluebirds.

Nice (1957:308), in her studies of nesting success for some hole-nesting altricial birds, recorded hatch rates for *sialis* ranging between 63.0 per cent and 80.1 per cent (averaging 71.5 per cent). The 58 per cent figure for Camp Hughes therefore seems to be abnormally low. This raises the possibility that various influences such as pesticides may have lowered the hatch rates for *sialis* in southwestern Manitoba in the past decade or so, assuming that Nice's figures provide a suitable norm, and assuming that the Camp Hughes figure reflects the nesting success of *sialis* in other areas of southwestern Manitoba.

Notice that in spite of the lower hatch rate for *currocoides*, the species has a larger average-sized clutch than *sialis*.

The nest success figures do not provide a complete picture, inasmuch as the majority of Mountain Bluebirds attempt second brood nestings whereas this is unusual for Eastern Bluebirds. Power (1966) found that 50 per cent of Mountain Bluebird pairs attempted second broods in Montana. Examining his data, we can derive that second brood nestings are about 77 per cent as successful as first brood nestings. If such is the case in southwestern Manitoba, then it follows that Mountain Bluebirds would have a considerably higher nest success rate per annum than Eastern Bluebirds. Also, Randall and Lane (1969) have suggested that more than 50 per cent

TABLE 2 Nest success survey, Camp Hughes, 1969

Box No.	Approx. Date Clutch Complete	No. Eggs Laid	No. Eggs Hatched	No. Young Fledged	Comments
A. Mountain Bluebird					
233	5-5	6	5	5	
871	5-12	6	6	6	
1100	5-8	6	5	5	
839	5-22	7	7	7	
726	before 5-11	5	0	0	—cause of failure unknown
949	5-14	7	6	5	
345	.....	0	0	0	—box taken over by Starlings
885	5-10	6	0	0	—vandalized
555	5-10	7	7	6	
465	.....	5	0	0	—box taken over by Tree Swallows
881	5-9	5	0	0	—vandalized
859	5-15	6	4	0	—cause of failure unknown
860	5-8	6	4	4	
880	5-12	6	0	0	—cause of failure unknown
882	5-13	6	0	0	—cause of failure unknown
82	5-10	6	0	0	—vandalized
67	5-10	5	4	3	
32	5-9	6	6	6	
546	before 5-25	5	5	5	
B. Eastern Bluebird					
341	5-6	5	3	3	
544	before 5-30	3	0	0	—all eggs infertile
496	5-11	4	1	0	—3 eggs infertile
663	5-11	6	5	5	
916	5-9	6	5	5	

FERTILITY RATES	Mountain Bluebird (a)	Eastern Bluebird (b)
Total number eggs laid	88	24
Total number eggs hatched	59	14
Fertility rate	73%	58%

(a) — excluding boxes 885, 345, 465, 881, 882, and 82, since it is unknown how many eggs would have hatched had incubation not been disrupted.

(b) — including all boxes, since failures were the result of infertile eggs.

HATCH RATES (c)	Mountain Bluebird	Eastern Bluebird
Total eggs laid	116	24
Total hatch	59	14
Hatch rate	51%	58%

(c)—including all boxes, since vandalism, etc. are definite factors regulating hatch rates throughout the entire nest line.

NEST SUCCESS RATES	Mountain Bluebird	Eastern Bluebird
Total eggs laid	116	24
Total young fledged	52	13
Success rate	45%	54%

of Mountain Bluebird pairs attempt second brood nestings in southwestern Manitoba. This is certainly true at Camp Hughes, judging from the large number of birds engaged in nesting throughout this area in July and August. It can be concluded that the overall nest success of Mountain Bluebirds is a major factor contributing to the phenomenal rise in numbers of

TABLE 3 Further trends in relative populations of bluebirds on the nestline.

Year	1963	1964	1965	1966	1967	1968
Number of boxes available	749	740	774	801	1200	1400
Number that were *currocoides*	28	50	66	79	160	242
Number that were not *currocoides*	721	690	708	722	1040	1158
Number that were *sialis*	22	29	40	47	55	50
Per cent that were not *currocoides* that were used by *sialis*	3.1%	4.2%	5.6%	6.5%	5.3%	5.2%

that species in recent years, not only near Camp Hughes, but possibly throughout southwestern Manitoba.

Discussion

As shown in Figure 2, both bluebird species increased fairly constantly up to 1966. In 1967 and 1968, however, *currocoides* accelerated its rate of population growth whereas *sialis* decelerated markedly. These trends indicate that factors not evident before 1966 influenced the population growth of *sialis* and *currocoides* thereafter. Apparently, these factors were introduced as a result of population increase of both species up to 1966, and possibly because of a limited number of nest sites. Assuming that this was the case, then it seems reasonable to consider an increase in interspecific interaction as one possible factor. Unfortunately, this report supplies no direct evidence that the number of suitable nest sites for bluebirds was limited.

Table 3 shows that there is always a large surplus of nest boxes not used by bluebirds. The figures from 1963 to 1966 indicate that *sialis* can use at least 6.5 per cent of the nest boxes not used by *currocoides*. In 1967 and 1968, *sialis* used less than this proportion. Because there is no evidence to suggest that this percentage is influenced by *currocoides*, we can assume that *sialis* is capable of commanding at least 6.5 per cent of all boxes not occupied by *currocoides*. Why, then, did this proportion fall below this figure to 5.3 per cent in 1967 and 5.2 per cent in 1968? Two alternatives are:

1) Because of other influences besides competition with *currocoides*, the percentage of nests not used by *currocoides* that could be used by *sialis* was lowered, excluding some pairs of *sialis* from breeding.

2) For whatever factors that were responsible for producing the number of breeding pairs that showed up in 1967 and 1968, there were insufficient Eastern Bluebirds to use all of the available nest sites in excess of those used by Mountain Bluebirds.

The first hypothesis assumes that the number of suitable nest sites was limited, in order that *sialis* would be excluded from breeding. The much better response of *currocoides* to large increases in nest boxes (Table 2), suggests that if either species was significantly limited by a lack of nest sites prior to 1967, it was *currocoides* rather than *sialis*. However, the fact that *currocoides* arrives earlier than *sialis* and Tree Swallows refutes this conclusion, since *currocoides* would have first choice of the available nest sites. But in view of the increase in the number of boxes that were not occupied by *currocoides*, especially in 1967 and 1968, and considering that the "other influences" of the first hypothesis would have had to be drastic in nature to reverse the trends in population growth of *sialis* to such an extent, the first hypothesis does not furnish a complete solution. On the other hand, the second hypothesis does not account for the apparent surplus of Eastern Bluebirds in such areas as Camp Hughes in 1967 and 1968, no matter how insignificant this surplus may have been. It may well be that, as in the second hypothesis, various factors diminished the *sialis* numbers returning in 1967 and 1968, and in addition, other influences such

as an increase in competition with species other than *currocoides* caused some of these returning birds to be excluded from breeding. At any rate, both of the proposed hypotheses indicate that territorial interactions and competition with *currocoides* are not necessarily critical influences regulating *sialis* populations in southwestern Manitoba in recent years.

The above discussion is based on the criterion that any limitation of nest sites would affect the entire nest line. It is therefore necessary to explore the possibility that lack of nest sites may be a localized problem. It is known that many areas on the nest line do not meet the habitat requirements of bluebirds, and therefore do not harbour either species. In spite of the many unused nest sites in such areas, any limitation of nest sites in one of the major breeding locations for bluebirds, such as Camp Hughes or Grand Glariere, could have profound effects on *sialis* numbers. In 1967 and 1968, for example, Camp Hughes held an unusually high concentration of bluebirds early in the breeding season, and it seemed obvious that late returning Eastern Bluebirds would either not find nests, or relocate. In those years, not a great deal of redistribution of *sialis* populations occurred on the nest line, and as a result, pairs of *sialis* apparently excluded from breeding were in evidence. The decline in the percentage of total nest boxes used by *sialis* in 1967 and 1968 at a time when populations of *currocoides* increased markedly (see Table 1 or Figure 2) suggests that a phenomenon of localized control of *sialis* numbers by *currocoides* may have occurred in southwestern Manitoba at that time. Conclusive evidence, however, remains lacking.

This report indicates that *currocoides* is dominant over *sialis* in interspecific strife and territorial disputes. This supports the belief that where nest sites are a limiting factor in regions of overlap between these species, breeding populations of *sialis* might to some extent be limited by high concentrations of *currocoides*.

Lack of suitable nest sites may well be the primary cause of population decline for *currocoides* in other parts of its range (see Power, 1966), for simply alleviating this problem in southwestern Manitoba caused a population expansion.

Acknowledgments

I would like to thank Mr. John Lane and the Brandon Junior Birders for their contribution to the field aspects of this project, and the following for comments and information: Mrs. N. Brooks, Herbert Copland, Martin McNicholl, Dr. Robert W. Nero, and Leslie North. I also want to acknowledge the help given by Dr. Roger M. Evans and Dr. Nero, both of whom critically reviewed the manuscript, and provided helpful suggestions.

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SOME OBSERVATIONS OF CAPTIVE GIANT WATER BUGS

by **J. E. Guthrie** and **S. L. Iverson,**
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We have used the giant water bug, *Lethocerus americanus* (Leidy), Hemiptera: Belostomatidae, to study the use of radiocesium (^{137}Cs) for the determination of food consumption by an aquatic insect which has piercing-sucking mouthparts. During this work, we made some observations of the habits of these insects.

L. americanus is one of several species of the family Belostomatidae found in the prairie provinces (Brooks and Kelton, 1967). In the vicinity of Pinawa, Manitoba, ponds and quiet pools in streams are typical habitats We have also seen them near the banks of the Winnipeg River. The giant water bug has been called the "fish killer" and, because it is attracted to electric lights, the "electric light bug" (Cummings, 1933). It is a dark brown insect, about 5½ cm (2 in.) long and 1½ cm (¾ in.) across the widest part of the body. The photographs, taken in the laboratory, show some of the features of the insect as well as give an impression of some of its habits and habitat. The insect's antennae do not appear in any of the photographs, because they are concealed in pockets beneath the eyes. This is a convenient arrangement for an insect which seeks its food in a tangle of underwater vegetation.

The giant water bug is a predaceous insect which captures and sucks out the juices of other insects, tadpoles, and small fish. At Pinawa, we have watched them capture and feed upon predaceous diving beetles (*Dytiscus* spp.) as big as themselves, and on small frogs *(Rana sp.)*. The giant water bug's bite is said to be quite painful (Batchley, 1926; Brooks and Kelton, 1967); but neither of us was eager to test this observation.

Laboratory Observations

Because of their predaceous characteristics, giant water bug nymphs and adults were kept in individual quart-size plastic food-freezer boxes with small holes in their lids. A small block of wood in each box provided a resting place for the insect. When disturbed or frightened, resting giant water bugs often ejected from the anal region, a dark green liquid with a peculiar fishy odor. This liquid may be comparable to the squid's ink cloud, or it may be an expulsion of the gut contents. Although most aquatic insects are probably silent, nymph and adult water bugs often made distinct squeaking and wheezing noises.

Our giant water bug nymphs (instars I to V) and adults were fed live tadpoles, except in some experiments in which they were offered small frogs. Tadpoles were attacked and seized by the grasping (raptorial) forelegs, then pierced with the beak. All that remained of the tadpole after it had been fed upon was its shrivelled

Fig. 1. Giant Water Bug in partially concealed position.

skin and some dark mud-like material in the digestive tract. Those tadpoles pierced at the base of the tail were quickly immobilized, even though some were larger than the nymph. Rankin (1935) suggested that the insect's saliva contains a poison which causes paralysis. The saliva may also contain enzymes which digest or liquefy the victim's tissues. Rees and Offord (1969) have isolated enzymes (proteases) which break down proteins from the salivary glands of a tropical giant water bug, *Lethocerus cordofanus* Mayr.

Our experiments (Guthrie and Brust, 1969) required that the giant water bugs be fed tadpoles or frogs one at a time to ensure that all food was eaten. Before being fed, the insects rested partially concealed in a waiting posture, with forelegs outstretched, as shown in Figure 1. If the victim swam past within lunging distance, it was instantly seized, the beak inserted, and feeding began. If the victim kept its distance, which it often did, the water bug gave chase (Cover illus.). As might be expected, hungry bugs chased prey more vigorously than ones that had been recently fed. Eventually, the victim was seized with the forelegs. Larger animals such as frogs or fishes resisted capture. If the quarry was struggling violently, the bug did not attempt to insert its beak—a water bug with a broken beak is doomed to starvation since it cannot grow another. The victim was held, sometimes with all six legs, until it drowned or became exhausted. Then the beak was inserted and feeding began (Figure 2).

Adult giant water bugs which had been fed their tadpole ration with forceps for seven to ten days became "lazy" and made no effort to pursue prey which slipped away. It seemed that the insects expected dinner to be served between their forelegs. If deprived of table-service for three or

Fig. 2. The victim has been subdued. The Giant Water Bug has inserted its beak through the thin skin covering the frog's abdomen.

Fig. 3. Head-on view of an adult giant water bug, *Lethocerus americanus* (Leidy). The grasping forelegs are seen just breaking the surface of the water. The large, stout beak or proboscis is between the forelegs. The prominent groove in the femur of the forelegs is one of the distinguishing features of this species.

four days, however, they began to chase their food again.

How these bugs survive over winter is not known. They may burrow into the mud in the margins of ponds and streams, but we have no evidence of this. We marked a number of adults living in a pond in late September, but none were found the following spring. They may have migrated to other ponds before freeze-up or immediately following the spring thaw. We did note, however, that water bugs in the laboratory became "restless" as summer waned. During the summer the adults seldom attempted to escape from their plastic boxes when the covers were removed, but as autumn advanced attempts to escape became more frequent. How the adult giant water bug survives the winter and the duration of overwintering are two questions to which those who are interested in observing aquatic habitats could contribute significant information. The size, availability, and interesting habits of this insect make it good material for observation by naturalists or biology students.

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"RED TIDE" IN WASCANA LAKE

by **M. V. S. Raju,** Biology Dept., University of Saskatchewan, Regina

In many parts of the world, particularly in the oceans, certain algae (commonly known as "water scum") bloom periodically in great abundance giving such an extremely intense red coloration that it has aptly been termed the "red tide." Such a phenomenon is occasionally seen in oceans, estuaries and fresh-water lakes. A similar red tide was observed early in the summer of 1969 in several parts of Wascana Lake and remained *very* prominent particularly in the months of July and August. It was earlier observed by the author in the summer of 1966 when the red color was not very intense and was confined to insignificantly small areas. Since then it has become increasingly abundant in the lake. Prompted by curiosity, a periodic collection of this red scum was made from various points in Wascana Lake, particularly in the Wascana Waterfowl Park area. Although this part of the lake was abundantly infested by a wide variety of green and blue-green algae (Fig. 6), attention was directed toward the unusually prominent red scum, color of which is not visible here (Fig. 5). A detailed examination of the red scum revealed that the organism which was causing the red tide was a species of *Euglena*, a member of the flagellate green algae.

Euglena occurs in nature as a unicellular alga growing abundantly in foul-smelling water, around old manure heaps, old farm yards, etc. In fact, a decent culture of this alga can be maintained, according to reports, very successfully for a long time on a culture medium containing rabbit droppings. Some species are known to occur in great abundance in sewage oxidation ponds. In these situations the cells can multiply with enormous rapidity because they metabolize successfully even under anaerobic conditions.

The single cell or the protoplast (Fig. 1) of *Euglena* does not possess a true cell wall that is commonly seen in most other plants. Instead, the protoplast has a highly modified peri-

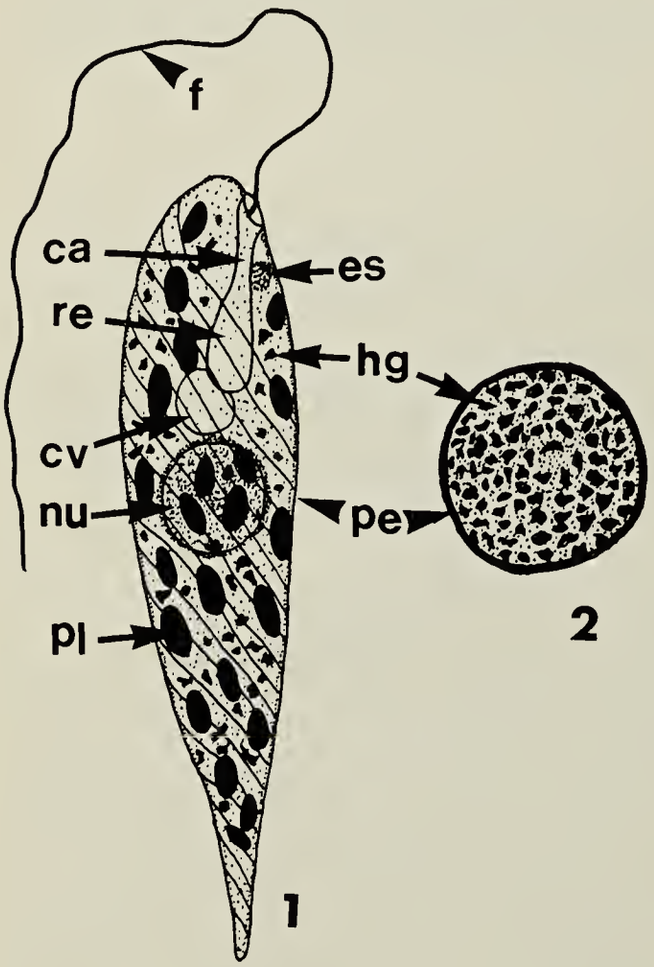


Fig.1. Diagrammatic sketch of an actively moving *Euglena* cell to show the cellular details.

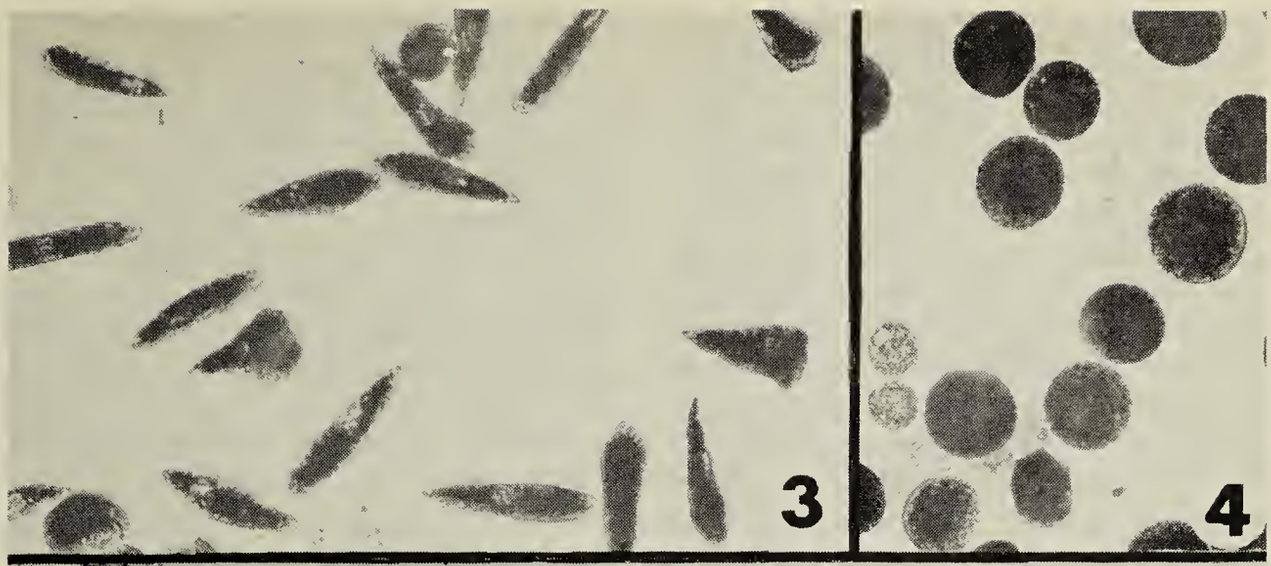
Fig. 2. A dormant cell of *Euglena*. (Explanation of labelling: ca, canal; cv, contractile vacuole; es, eye-spot; f, flagellum; hg, hematochrome granule; nu, nucleus; pe, pellicle; pl, plastid; re, reservoir.)

Fig. 3. Actively moving cells after they were revived from dormant condition in the laboratory. Note different shapes of cells. x 200.

Fig. 4. Encysted dormant cells with abundant hematochrome granules. x 200.

Fig. 5. Picture to show algae at the edge of the lake (eg, euglena red tide; ga, different genera of green algae).

Fig. 6. Picture showing algal bloom in the Wascana Waterfowl Park.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pheral region called the "periplast" or "pellicle." The pellicle in *Euglena* is flexible in the sense that it shows rhythmic expansion and contraction depending on whether the alga is in motion or not (Fig. 3). The nucleus and the plastids can be recognized easily under the microscope (Fig. 1). The green plastids are extremely useful in photosynthesis and through this process the cell can synthesize carbohydrates which are normally stored within the cell. At the anterior end of the cell there is an opening which leads into an invagination called the "gullet" which is composed of an upper "canal" and lower "reservoir" (Fig. 1). The opening and the gullet are useful in the direct ingestion of minute food particles and other micro-organisms for the nutrition of the cell. Adjacent to the reservoir and often closely associated with it are a few contractile vacuoles which help in the translocation of ingested food particles into the body of the cell (Fig. 1).

Arising from the floor and passing through the gullet to the exterior there is an elongated whip-like flagellum (Fig. 1) whose constant lashing, in addition to rhythmic expansion and contraction, helps in the motility of the cell (Fig. 3). The movement is further known to be aided by a red-pigmented body or eye-spot situated adjacent to the gullet toward the anterior end (Fig. 1).

The cells of *Euglena* collected from the Wascana Waterfowl Park contained small granules distributed between plastids. Such granules containing a pigment, hematochrome, become extremely conspicuous under certain conditions; several millions of such cells aggregated in dense masses along the edges of the lake and along the periphery of other green algae gave a brick-red color, which phenomenon is the "red tide" (Fig. 5). In an actively moving cell, the plastids remain peripherally placed, almost overshadowing the hematochrome granules, and the cells consequently show green color (Fig. 1). On a hot day, however, when the intensity of sunlight is high, the cells of *Euglena* have a tendency to become sluggish and almost stationary (Fig. 3). Such cells become rounded and a thick pellicle appears around each (Fig. 2, 4). At the same time, the cell loses its flagellum or retracts it until the advent of favorable conditions. In most of such dormant cells the green plastids get aggregated in the middle and they are surrounded by the hematochrome granules (Fig. 2, 4). Consequently, the green color of the plastids is masked and the cells look brilliant brick-red or blood-red, particularly in the months of July and August in the prairies when the sun is very bright and the temperature remains high. If the cells are placed in the laboratory at room temperature and under low light intensity, the encysted cells gradually start changing their shape showing a pulsating or wriggling movement (Fig. 3) until the cells produce their own flagella which help in the characteristic directional movement of cells.

The cells of *Euglena* are known to multiply vegetatively by longitudinal splitting. There are also some reports which indicate that the cells can divide in the encysted condition by producing more cells. These cells are liberated to the exterior after the rupture of the parent cell wall.

In the light of published information and of the present observations, the occurrence of the "red tide" in Wascana Lake can be interpreted as an instance of extreme algal bloom. One can also draw from this two important conclusions. Firstly, the area in which the alga, *Euglena*, is growing luxuriantly must be unusually and supra-optimally rich in nutrients. This phenomenon may popularly be referred to as "pollution." Secondly, it is possible that this bloom is an indication of the competive ability of the alga. This can be achieved by developing certain internal mechanisms, many of which are not clear at present, that aid the alga in the maximum exploitation of available nutrients. The alga can compete by producing certain toxins that may be detrimental to other algae, and to other flora and fauna. In fact, there

are several published reports, although not exactly on *Euglena*, which show that blue-green algae, such as *Microcystis*, *Anabaena*, *Aphanizomenon*, which are also abundant in Wascana Lake, are known to produce substances that are toxic to some of the associated flora and fauna. Although there is not much convincing evidence to show that *Euglena* produces substances of the toxic type, it is possible that it could. Active research in this direction is phenomenally slow.

Euglena and some blue-green and green algae are known to be good indicators of pollution. They can thrive well in ponds and lakes containing high concentrations of organic and inorganic substances which could be inhibitory to the normal growth and development of other organisms. They are known to grow successfully on sewage where there is high depletion of oxygen, and also in other polluted areas caused by mine wastes. In view of all the evidence at hand, one should undoubtedly be concerned with the "red tide" of *Euglena* in Wascana Lake. There are also many other green and blue-green algae that may have contributed directly or indirectly to the supposedly polluted areas of Wascana Lake.

Although there is circumstantial evidence showing that Wascana Lake, at least in areas where *Euglena* red-tide was noticed, is polluted, still we are not certain as to the type of pollution, whether it is formed as a result of natural causes within the lake itself and/or of man's intervention in some way. In nature we always recognize the death of larger consumers, such as birds, fish, etc., and attribute it to pollution. The death of consumers may be due to several factors: the algae by themselves may be toxic or they may release toxins into the environment and bring about mortality among both producers and consumers that live there. In view of our limited knowledge of the facts of pollution, serious efforts should be made to study intensively various aspects of the biology and biochemistry of the flora and fauna of Wascana Lake with particular reference to the producers such as algae and other micro-organisms. A detailed study of the environment in which such organisms live is also imperative. In regard to the red tide of *Euglena*, it is important to determine the internal and external factors that stimulate phenomenally the growth and development of the alga.

Considerable time, effort and money should be expended to carry out detailed biological investigations of Wascana Waterfowl Park and other adjacent areas. The results of such work could not only be exemplary for the prairies but could also help solve the problem of fresh-water lake pollution. Work of this sort may also give some clues that would be significant enough to effect proper measures of pollution control.

NEW OR UNUSUAL PLANT RECORDS FOR SASKATCHEWAN, 1969

by **John H. Hudson,** 81 Morris Drive, Saskatoon

This summer I was given material of a *Silene* which appears to be *S. conoidea* L. It was collected July 14 on the farm of Mrs. P. Bayoff, 3 miles S. of Verigin, when it had been growing as a weed in a barley field. As I did not see the plant alive, I shall not try to describe it; a description will be found in Boivin, Vol. 2, p. 94. He reports it from Lacombe, Alberta. A question may be asked about rare weeds of European origin like this; are they recent introductions (in which case they'll spread) or have they been with us since the early days of settlement, but aren't very aggressive?

I found *Najas flexilis* (Willd.) Rostk. & Schmidt on August 10, 1969, in Pike Lake just west of the public

beach. It is very rare in Saskatchewan, the only sheet in the Fraser Herbarium came from Great Sandy Lake (Hanson Lake Road). As to recognition, it is one of those limp submerged aquatics, in this case an annual rooted to the bottom, with opposite serrate linear leaves and inconspicuous oblong fruits some 2 mm. long sessile and singly in the leaf-axils. The point about this finding is that W. P. Fraser and students botanized Pike Lake thoroughly in the 1930's and did not get it. The plant is not all that inconspicuous—chunks break off and are washed up on the beach, thus announcing its presence to those who are looking—and I do not think Fraser could have missed it. The alternative explanation is that *Najas* has come in since, perhaps since Pike Lake was made a provincial park. It is common in Eastern Canada.

Buchloe dactyloides (Nutt.) Engelm., the Buffalo Grass of the American short-grass plains, I had the good luck to find at Estevan, August 4, 1957 (*Blue Jay 16*, 20-21, 1958), as the first record in Saskatchewan. Another colony turned up this summer, also at Estevan, on SW ¼ 30-2-8 W2, some 2 miles NNW of the earlier discovery. This lot was growing around a stony depression on clayey prairie, of the sort which holds water only a few weeks in spring and soon dries up leaving cracked clay carrying a sparse annual vegetation rather than an aquatic flora of any sort. Associated species were *Polygonum aviculare* (native form), *Plantago elongata, Schedonnardus, Poa secunda*. Geologically the site was thin (5'-10') till over grey sandy clay of the Estevan beds of the Ravenscrag formation. The point is, the *Buchloe* was not growing in climax grassland at all but on a site, though usually dry, subject to just enough flooding to make the life of climax grasses like *Stipa, Koeleria, Bouteloua*, etc. impossible. The influence of bedrock shales may also play a part in rendering the soil more barren and thus making life tougher for climax grasses. The earlier location, SW ¼ 17-2-8 W2, a dry gumbo flat on the bottom of a valley tributary to the Souris River, also possessed the properties of rare flooding and bedrock shale influence. This restriction of *Buchloe* to a habitat which is effectively disturbed is doubtless due to being at the edge of its range, where it can survive only if freed of some of the competition. Further south it is a member, a dominant member, of a short-grass prairie community.

As an irrelevant sideline, the pothole in question had a little water in it on July 22 because of recent heavy rains. My attention was drawn to the *Buchloe* and its habitat by our truck getting stuck in this low gumbo spot, whereas we'd been passing over climax prairie, sodden though it was, without difficulty.

CROCUS NOTES FROM DAWSON CREEK

By **Dorothea Horton Calverley,** Dawson Creek, B.C.

The article on the Crocus Anemone in the September 1969 *Blue Jay* prompts me to add a note or two.

The super-abundance of the crocus in the spring of 1969 extended also into the Peace River country. Whole hillsides in the vicinity of Dawson Creek and out into the foothills of the Pine Valley gave from a distance the appearance of a scarf of delicate blue-orchid having been flung over them. Old-timers said that never before had anything like it been observed.

Whether the fact that the winter of 1968-69 was the coldest in memory had anything to do with it is an interesting question. During the two previous springs untimely and exceedingly heavy frosts in mid-May, after warm spells in April, froze even these super-hardy flowers so that, except in very few places, they produced no seeds. This year's flowering

may have been a compensating effort.

During the winter of 1968-69, there were no Chinook winds. The average temperatures during January at hourly intervals was –1°F for as many years as the airport has existed. In 1969 it was –26°. For 28 or 29 days the temperature never rose above 0°. One might suppose that such prolonged cold might affect the flowering shrubs. Not so. This observer has never seen, in 35 years, such shows of flowering currants, gooseberries, huckleberries, etc. Oddly, the fruit of Saskatoons persisted extraordinarily late in some places. We found an abundance of large sweet berries in mid-September long after the usual term of fruiting.

On the subject of white crocus: When the bridge over the Peace River at Taylor, B.C. fell down, the road was forced over a by-pass on a river-flat to the railway bridge up-river. There we found several clumps of "white" crocus. They were not "albino" forms because near the centre of the flower, the sepals were flushed with yellow. I have been told that occurrence of white crocus is fairly common along the Peace River.

Further, I found that crocus in abundance grew in the extremely sandy soil in the jack pine forests near Hudson's Hope. This was surprising to one who expected them to be at their best in the deep, grassy, virgin loam of the prairies. After submitting specimens to the provincial botanists at Victoria I discovered that these crocuses are of a different type, identified by Dr. Adam Szczawinski as *Anemone patens* (L) Ssp. *multifidia* (Pritzel) Zancels. From my further study of the plant, I gather that the crocuses at Hudson's Hope are related to Arctic varieties.

Concerning the White Crocus, Dr. Szczawinski notes that Dr. Moss in his *Flora of Alberta* lists it under the name *Anemone patens* L. var. *wolfgangiana* (Bess.) Koch, in which a "nearly *white* form may be found at that time (June, 1961 quoting Dr. Szczawinski "the White Crocus has been found in B.C. but localities and general distribution (were) still pretty vague.")

A special difficulty exists here in studying the crocus. The deer range in spring over the grassy places where the above crocuses abound. An old-time trapper's wife, Mrs. Durney, told me that the deer eat the flowers greedily when they first appear apparently as some sort of "tonic" or dietary necessity. Frequently where deer or cattle range (and children don't) one finds plants with flowers closely nipped off.

Photo by Robert A. Mitchell

Crocus Anemone at the Pas, Manitoba

Junior Naturalists

Edited by **Joyce Deutscher,** 7200 6th Ave., Regina

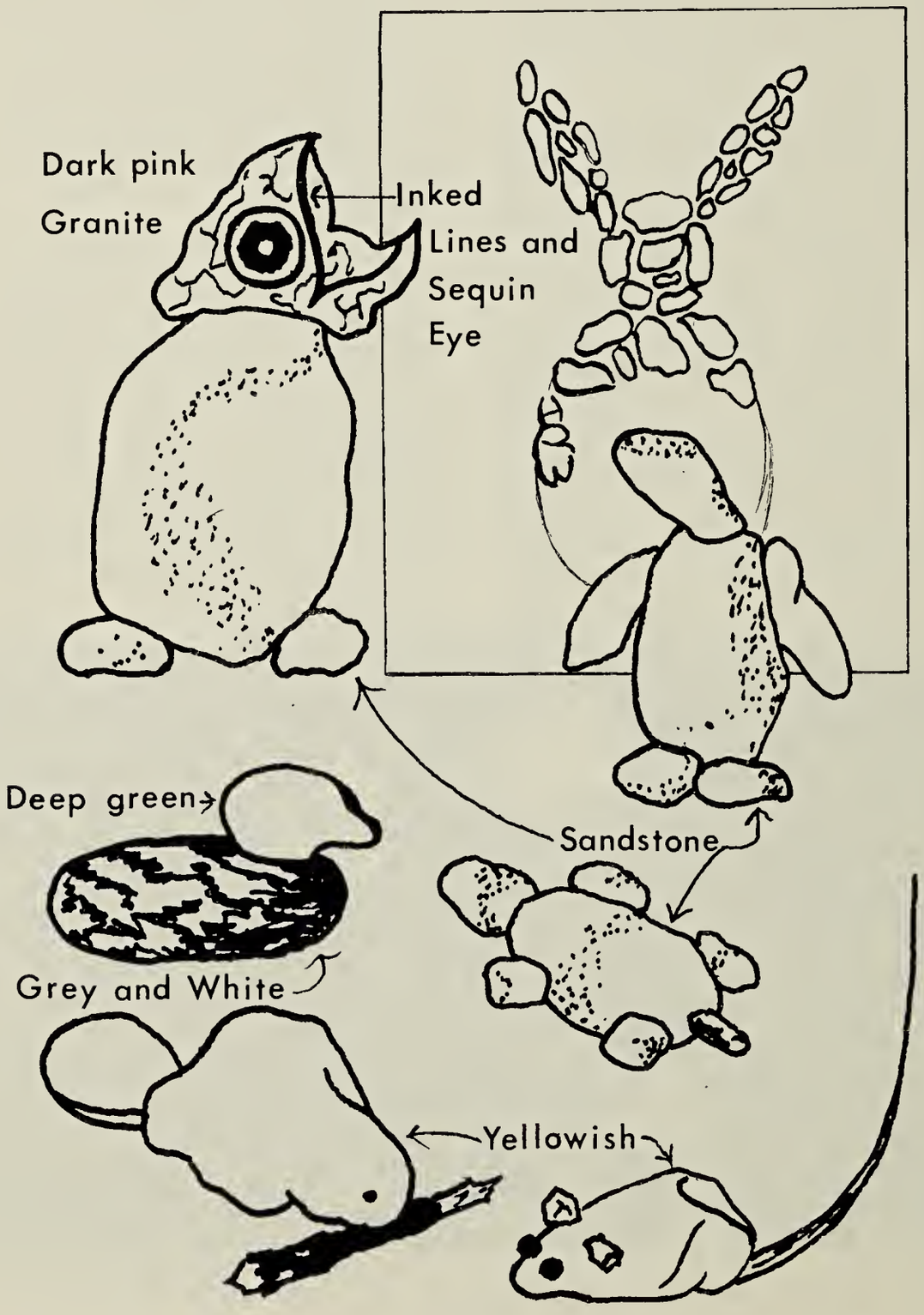
NATURE HOBBIES

by **Helene White,** 7732 Jasper Avenue, Edmonton 20, Alberta

Pebbles of varied colours, shapes and sizes can be picked up now even though a late snow storm seems to have blocked all the roads to spring. The sun has been busy nibbling away at winter's armour in many sheltered spots, laying the earth bare. So let's start a rock collection.

Wash your collection, and while it dries, gather together a roll of wax paper, some salt or sand, a small box, a bottle of white all-purpose glue and a square or two of cardboard.

The cardboard will provide the backing for a mosaic picture. This is the best project to start off with if the outline is kept simple. It helps you to get to know your stones and even the youngest member of the



family can glue pebbles inside a simple bunny outline.

Once you start to see shapes in your rocks graduate to the turtle. Select and arrange your stones on a piece of wax paper then glue your critter together. When the glue has dried just peel the paper away.

The feet of the penguin, set side by side, were glued together on wax paper too. The rest of him was laid out on a bed of salt in the small box and glued together. Then, when all pieces were dried, the feet were cemented to the body and he stood on wax paper, propped in place by a couple of larger stones until he dried completely.

The salt box came in handy for the wood duck too, because his head kept slipping out of place. I marked the spot for his head, buried the body, added glue and the head, then kept the head where it belonged with a wall of the salt. Since the owl's head was just as stubborn, it was treated in the same way. His feet were glued in place as he stood up and, because he insisted upon wobbling, a very tiny pebble was glued under him for balance.

Balance was no problem in constructing the beaver, but you must first be able to visualize the final product in order to choose the appropriate rocks for each section of the body. Then just glue them together. The same thing applies to the mouse, my favourite. Watch for a likely shape, add two tiny rock chips for ears, seed beads or black chips for eyes and with a grass tail he is ready to grace anyone's rock collection.

Each one of these critters was originally part of our gravel driveway. With a little imagination, rocks and glue, an interesting pastime developed.

Even the humblest rock is interesting. The planet we live on is one huge rock ball. The soil that gives us life was once rock before exposure to the weather and microscopic animal and plant life started to work on it for us. Rocks are very important history books, telling us how our earth evolved and (now they tell the story of the moon.)

Rocks, directly or indirectly, provide us with fuel, bricks for buildings, clay for our dishes, metal for our cars, pots and pans and countless other things that we take for granted every day.

Common ordinary rocks and their hidden minerals are nearly as important to us as the air we breathe, so have fun, learn a great deal at the same time,* and display your pebble pets with pride.

*Ed. Note: This might be the moment to visit the geology section of the Saskatchewan Natural History Museum in Regina. Hopefully you will become interested in attempting to identify various rock formations.

BANDING HORNED OWLS

by **Rosemary Nemeth,** Yellow Creek

Last year my Dad and I found five horned owl nests. We started looking for them in March with our Ski-doo. Then on May 11 Dr. Houston and three of his helpers came to band the young owls. The first nest had two young and for food they had a hind quarter of a rabbit. Two young were banded in the second nest which contained no food.

In the third nest, two were also banded. This tree was awfully thin and the climber couldn't see if there was any food in it or not. Three were banded in the fourth nest in which there was no food. The fifth nest had the most young of all; there were four and for food they had pocket gophers. Dr. Houston and his helpers banded a total of thirteen young out of the five nests. I am looking forward to another trip next year.

MALLARD IN BALESTACK

by **Janet Gray,** age 14, Indian Head

In the first part of June, 1969, my brother spotted a Mallard duck sitting on her nest ten feet up in our balestack beside the barn. She was not disturbed by our presence. In fact, she didn't even move when we lifted her up to examine her eggs; she only hissed at us. She seemed very tame. Closer observations revealed that she

had eleven eggs that were starting to hatch. The next morning my Dad took a picture of her while he was in the bales and about an hour later the duck and her eleven ducklings were down at our dugout about a hundred yards away. Several days later we found them in a slough approximately four hundred yards from the dugout. However difficult the trip, nine out of the eleven survived.

BIRD HOSPITAL

by **Brian Scott**, age 14, Indian Head

On October 28th, I came across a wounded Slate-colored Junco. It had probably hit a power line. I noticed that its wing feathers were out and that it had been bleeding. I had him in a cage for over a month, feeding him on wheat, flax seed, and canary seed. In the mild weather of early December, I let the fully recovered junco go.

I also looked after a wounded pigeon. In the spring of 1968, our neighbours brought over a wounded pigeon with a band on its leg. I had it for two weeks or more and decided to see whether the pigeon could fly or not. When I opened the cage door, it flew away as if it had never been wounded.

CONTRIBUTIONS TO THE JUNIOR NATURALISTS PAGE

Send your illustrations, stories and letters about nature to Mrs. Joyce Deutscher, 7200 6th Ave., Regina. We will be looking forward to hearing from you.

The Blue Jay Bookshelf

POPULATION ESTIMATES OF BARREN-GROUND CARIBOU, MARCH TO MAY, 1967. By Donald C. Thomas. 1969. Canadian Wildlife Service Report Series No. 9.

The barren-ground caribou of the Canadian Arctic and Sub-Arctic are (and have been for untold years) a valuable source of subsistence for the Eskimo and Indian people of our country just as the reindeer (wild and domestic) are to the Hyperborean tribes of Eurasia.

That in the last half century (especially) the numbers of these animals have been considerably — it was thought dangerously — reduced, has been a matter of concern to those interested in the continuance both of aboriginal people and of wildlife.

It is therefore good to read in this booklet that the situation appears to have improved in the last decade, at least up to 1967, the year this report was produced; but before becoming over-optimistic we must stop to consider that since then the "Arctic fever bug" has bitten industry far more deeply; and so rapidly is the mechanical invasion of our Arctic regions being pushed forward that the future is almost unpredictable. Any changes in environment caused by lowering the water levels or fire or possible pollution can from now on work only to the disadvantage of not only the hair-trigger balance of wildlife but of our own native peoples. "Messing about with" this unique and highly vulnerable area could be as fatal as plowing-up semi-desert lands, or even more so.

In summary this report comprises a condensation of the results of an aerial census survey made from March to May 1967 by the author, who contracted with the Canadian Wildlife Service to cover the Mac-Kenzie District of the N.W.T. and parts of adjacent Alberta and Saskatchewan: all west of the 102nd meridian. The first job was to locate the main herds in the area. A number of flights were carried out to determine spring migration routes, to make a census, and finally to assess utilization by hunters, etc., on winter range.

The main herds in the area dealt with are:

(1) The Bluenose herd — winter range north of Great Bear Lake.
(2) The Bathurst herd — winter

range east of Rae and Yellowknife.

(3) The Beverly herd—winter range Lake Athabasca and north.

(4) The Kaminuriak herd, closely allied to the Beverly herd, wintering east of Lake Athabasca and east to Brochet and Churchill, Manitoba. This latter herd was not fully censused as part of it occupies the country east of the 102nd meridian.

Small scattered groups met with were credited to the nearest large herd thus named.

It is interesting to note that the farthest north herd (Bluenose) winter almost at the edge of the tundra and start migrating eastward and northward into the open country as early as March. The Bathurst herd penetrates into the treed country upward of 20 miles, leaving for the tundra in April, while the Beverly herd (Lake Athabasca region) goes even farther into the "timber" and is not out in the tundra till May. As for the most southeast herd, the Kaminuriak, which have gone farthest of all into the shelter of the forest—they do not arrive in the barren lands till late May. At first, though, one would expect the movements to be the other way around; but these migration dates are due to the fact that in the north the snow is less deep than in the south and east; the caribou dislike travelling in the deep, hard-crusted snow of the open country, and so remain among the trees where the snow is looser.

A section of this report deals with the highly technical matter of computing the number of caribou by the strip-census method. It has been most carefully compiled, and with the assistance of maps and graphs is easily understood.

The total number of caribou in the given area was (in 1967) 322,500, and if we add an estimated 65,000 animals living outside the census area, we find a total of about 387,000 caribou in the western Arctic and sub-Arctic.

The author estimated that about 12,500 animals were taken by natives and white trappers in the census year, which equals about 4 per cent of the total population. It would be necessary to add to these figures those taken by wolves and deaths from other "natural" causes to get the full percentage of annual loss; but I personally feel that these could to some extent be bulked, because so much of the wolf take would be animals already doomed to die from old age, sickness and broken limbs. Conversely, much caribou meat eaten by wolves would be animals already dead.

The author also mentions another factor which operates against the caribou herds: fires which yearly denude large areas of good caribou grazing in their wintering range, especially in the Lake Athabasca area, and to some extent between Great Slave and Great Bear Lakes. This hazard can, one fears, only go from bad to worse within the next few years. And we might remember that caribou moss cannot replace itself in one season, or even in ten or fifteen, as does the grass of the prairie.

Touching again on the native "take" of these animals, this may shrink now that so much government welfare assistance is provided to the native peoples. However, this might be partly offset by the use of "Skidoos" when the Eskimos of Bathurst Inlet acquire these "weapons".

The photographs which illustrate this very interesting booklet are extremely good; but I do feel that the report would have been easier to follow if those place names mentioned in the text had been shown on the maps in darker type or even in red; because there are so many place names on these maps that it is difficult to pick out the key names. Apart from that one weakness—a very common one—this is a booklet well worth reading slowly and carefully by all interested in our possession of such a wonderful source of protein food in an area where domestic stock would perish. Profiting by its note of warning, all Canadians should demand of industry that it be most particularly careful in its development projects.—*R. D. Symons*, Silton.

Letters and Notes

NOTE TO MEMBERS

We are anxious to keep a growing membership but increases in postage rates and other costs have forced us to raise the membership fee to a minimum rate of three dollars. Many members will be tempted to drop out and the *Blue Jay* cannot be sent to anyone in arrears. We do especially need all our members this year so if you know anyone who did not get a *Blue Jay* please urge him to pay at once. We have much conservation and anti-pollution work to do so let us all get at it.

THE PRAIRIE DOG BARKS AGAIN

In 1962 Mr. George Hooey* of Swift Current accompanied me in making a survey of the Black-tailed Prairie Dog colonies in the Val Marie area of southwestern Saskatchewan. The report of that survey is in the September 1962 *Blue Jay*. At that time there were six active colonies in fair to very good condition.

In mid-June of this year, Mr. Hooey and I attended the summer meeting of the Saskatchewan Natural History Society in the Val Marie area. The program included the dedication of the cairn to the Prairie Dog. The cairn is on crown land formerly leased to Mr. Purask but now leased to the society.

On June 14 we found that this colony had increased greatly since 1962, no doubt due to the protection and publicity given to it by the society. On Sunday, June 15, we followed most of the trail of 1962 again. The only area showing a decrease in Prairie Dog population was on the property of Mr. Larson. His foreman assured us that they had maintained a program to keep the Prairie Dogs under control.

Mr. Murray Dixon on whose property there are two colonies stated that they were giving him some concern as they were spreading considerably but that he had not taken any control action. We did not have time to inspect the colony in the Dixon pasture, but Mr. Hanson told Mr. Hooey that it was spreading to the extent that considerable vegetation of value to livestock was being consumed by the Prairie Dogs.

It is my opinion that Black-tailed Prairie Dog is maintaining its population in Saskatchewan. I have an aerial map with the colonies we visited marked thereon. Anyone interested is welcome to see it.—*E. L. Paynter*, Regina.

*We have just learned with regrets that Mr. Hooey died at his home February 6, 1970.

BLUE JAY BOOKSHOP

The Broken Snare by R. D. Symons will probably be released in April. The price will probably be $6.95. Order your copy from the Bookshop now if you are not a member of the Book-of-the-Month Club. We will have a review in the next *Blue Jay*.

The Atlas of Saskatchewan compiled and produced by the University of Saskatchewan as a centennial project is receiving high praise. The editor is Dr. J. H. Richards and the cartographer is Professor Ka lu Fung. The printing was done by Modern Press in Saskatoon. $15.00.

SNHS SUMMER MEET, 1970

The June meeting this year will be held in and around Waskesiu, June 12, 13, 14. Those interested in accommodations should get their reservations in early. Details on accommodations and programme will be in the April Newsletter.

THE SASKATCHEWAN NATURAL HISTORY SOCIETY

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All items for publication should be submitted to George F. Ledingham, Editor, 2335 Athol Street, Regina.

MEMBERSHIPS

The classes of memberships in the Saskatchewan Natural History Society are as follows: *Regular*, $3.00; *Supporting*, $5.00; *Sustaining*, $10.00. The *Blue Jay* and *Newsletter* are sent without charge to all members not in arrears of dues.

Send all renewals and new memberships to James Jowsey, SNHS, P.O. Box 1121, Regina.

REPRINTS

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SASKATCHEWAN NATURAL HISTORY SOCIETY